TECHNOLOGY DEP

THE FOUNDRY

July, 1950

wherever metals are cast...

Helpful...easy to read..
handy for reference—th
12-page booklet will hel
your foundry to mak
better cores. The infor
mation it contains wa
collected by our Foundr
Research Laborator
during several of thei
research projects.

WRITE FOR
YOUR COPY
TODAY!

FR v.78 2 July Dec. 1950

*Purite

FOUNDRY-PROVED ADVANTAGES GUARANTEE

Better Castings

When foundry after leading foundry changes to Purite and then continues to use it, you know there must be good practical reasons for the success of this economical desulphurizer and cupola flux. There are! Just note these outstanding advantages:

1. **Purite gives 100% fluxing action in the cupola — 100% desulphurizing action in the ladle.**
2. **Purite gets to the iron quicker — no faster desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2-lb. pigs — no weighing or measuring required.**
5. **Purite is 100% fused soda ash—you do not pay for inert materials.**
6. **Purite does not crumble—no waste—no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments—is easily stored without deterioration.**

These day-to-day benefits explain why leading foundries throughout the country regard Purite as the foremost cupola flux and ladle desulphurizing agent. Write today for specific information on how Purite can improve your iron. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

*PURITE

100% FUSED SODA ASH

The Scientific Flux for Better Melting and Cleaner Iron

Mathieson CHEMICALS

7910

Purite is sold by all leading foundry supply houses in the United States and Canada.

TECHNOLOGY DEPT.

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JUN 23 1950

CAST IN NICKEL-CHROMIUM IRON, by the Atlantic Foundry Company of Akron, Ohio, this lead melting pot is used in a large rubber plant. It is subjected to temperatures ranging from 620° to 950° F. 24 hours per day. The pot has an inside diameter of 81", is 42" deep and weighs 7,520 lbs.

LICK scaling...distortion...thermal shock ...with *NICKEL CAST IRON*

To assure long service life, this giant lead melting pot was produced in a cast iron containing 1.75% nickel and 0.75% chromium.

This and similar compositions have shown marked superiority to unalloyed iron in applications that call for resistance to destructive effects of moderately high temperatures.

Hundreds of progressive foundries now use nickel to secure these basic advantages:

IN THE FOUNDRY—Nickel aids the progressive foundry to meet high mechanical property specifications. It is employed in the production of engineering cast irons because it strengthens the pearlitic matrix of the iron, produces finer and more highly dispersed graphite and discourages the formation or retention of hard carbide particles.

IN THE MACHINE SHOP—Nickel cast irons provide readily machinable castings that take a smooth finish because of their improved structure and uniformity, particularly where changes in cross-section introduce difficulties and losses with unalloyed irons.

IN SERVICE—Nickel cast irons are strong and pressure-tight, thereby eliminating a frequent source of trouble in pumps, valves, pipes and fittings.

Ask us for information about the advantages nickel alloyed irons provide for specific applications. Write us today.

EMBLEM OF INCO SERVICE
TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N.Y.

IN CASTINGS OR IN SYMPHONIES,
PERFECTION IS ATTAINED THROUGH

control

GREEN BOND

If the strength and volume of a philharmonic orchestra were not controlled, the result would be chaos, or general pandemonium. If the strength of a molding sand were not controlled, there would be very little casting at a profit. FEDERAL GREEN BOND, processed from the finest Western Bentonite, is a definitely superior bond. It can be mixed to produce a firm, unyielding sand, or a sand that collapses readily and flows freely. There is no variation in the quality or uniformity of GREEN BOND—a shovelful from one bag, or an entire carload show the same properties and characteristics. Foundrymen like GREEN BOND after the first trial—after that, they are friends for life.

THE BEST OF THE BENTONITES

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JULY, 1950

THE FOUNDRY

VOLUME 78—NUMBER 7

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a BOILER is born . . .

Central heating is one of the reasons why we can enjoy comfortable living and working conditions. Radiation — whether radiators, convectors, baseboards, or panels — keep each room at a comfortable temperature. But the "heart" of this entire system is the boiler.

The finest of today's boilers are made from cast iron sections. One of the oldest manufacturers of cast boilers is The H. B. Smith Company, Inc. of Westfield, Massachusetts.

Since a boiler is itself a maze of hollow water tubes, the core room in a boiler foundry is an important spot. Boiler-section casting quality is largely dependent on core performance . . . this is the main reason why LINOIL has been the specified core oil in the H. B. Smith foundry for many years. These photographs show some of the steps in the manufacture of a Smith-Mills "44" boiler, and explain how LINOIL helps to make better boiler castings.

LINOIL-bonded core sand has been packed into two core boxes that make up a boiler section core, then tamped and struck-off. Now the core halves are ready for . . . .

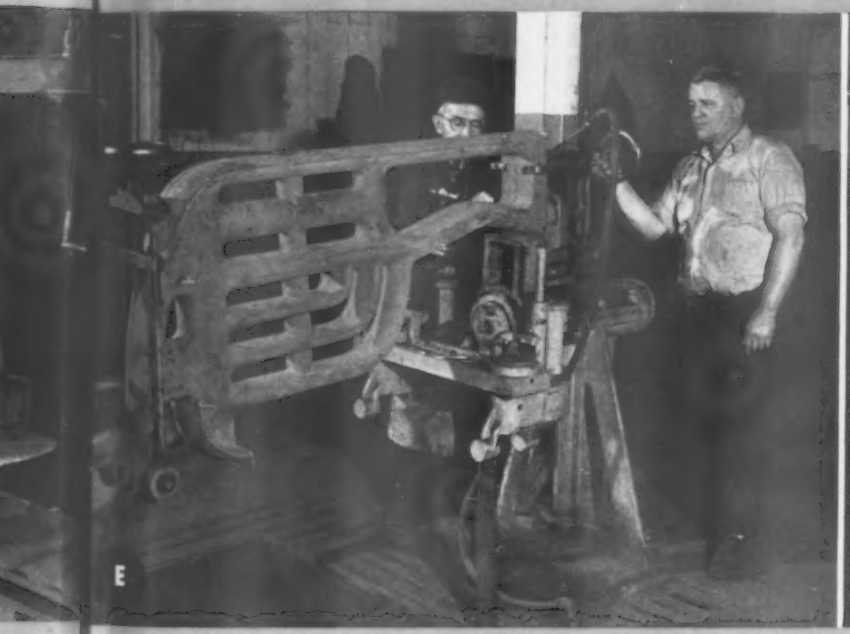
After baking, the core is assembled into the mold. This core must be smooth-surfaced and hard—strong enough to support its own weight. Next comes pouring, shake-out, and cleaning and then . . . .

at THE H. B. SMITH CO.
WESTFIELD . . . . MASS.

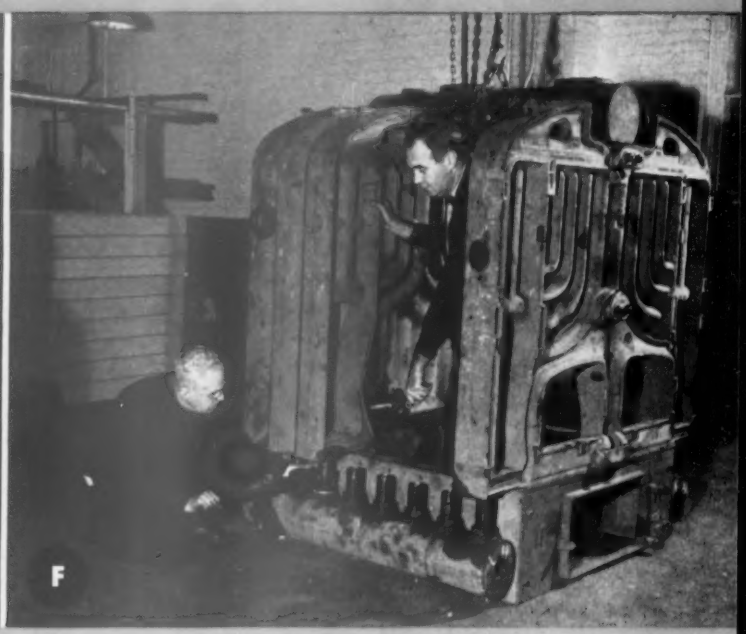
. . another LINOIL story

. . . . "booking". The boxes are closed, rapped, then the top box is drawn from the core. It's important here that the drawing is smooth and sand does not stick to the boxes.

After the "book" is opened and hinge pins are withdrawn, a complete core is ready for the ovens. The "filler" half of the core box will be hinged to another drier half, ready to make the next core.



. . . . the section casting is hydrostatically tested. Here is where LINOIL'S performance is really proven — no pin holes from gases; no blocked passage-ways due to broken pieces of core . . . nothing but a perfect casting is acceptable.



The sections are machined and finally assembled into a boiler. This particular model is a Smith-Mills "44-8" boiler, adaptable to firing with either coal, gas or oil.

LINOIL
THE LOGICAL OIL

ARCHER-DANIELS-MIDLAND COMPANY

(THE WERNER G. SMITH CO. DIVISION)

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Look

ROTOBLAST

means high-speed, low-cost blast cleaning!

ROTOBLAST cleans faster and saves you money. For example, a ROTOBLAST Barrel like this can replace as many as five old-fashioned machines, clean more castings per hour at a substantial cash saving—with virtually no breakage losses!

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Pangborn

* Trademark of Pangborn Corporation

ok how much Pangborn ROTOBLAST* saves per month!

HERE ARE FIVE WAYS ROTOBLAST SAVES YOU MONEY

SAVES LABOR

One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.

SAVES SPACE

In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.

SAVES TIME

Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared with old-style methods.

SAVES POWER

Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.

SAVES TOOLS

On work cleaned with ROTOBLAST, cutting tools last up to 2/3 longer because no scale is left to dull edges.

SAVINGS MEAN PROFITS

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

$454 AT CHAMPION BLOWER AND FORGE

$846 AT HARRIS-SEYBOLD

$925 AT LEWISTOWN FOUNDRY

$423 AT YATES-AMERICAN MACHINE

In foundries from coast-to-coast, famous Pangborn ROTOBLAST is setting *new records* for *low-cost, high-quality* blast cleaning. Cases in Pangborn's files prove ROTOBLAST cuts cleaning costs up to 50%, reduces cleaning time *by* ½—gives you cash savings in time, labor and overhead.

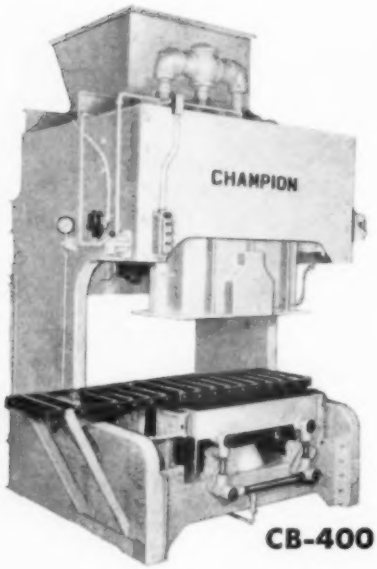
In a large Ohio foundry, ROTOBLAST saves almost $1000 a month on labor alone. In a medium size eastern foundry, ROTOBLAST saves more than $100 a week. And in a jobbing foundry, one Pangborn ROTOBLAST unit has replaced five old-fashioned machines, cleans castings 18 times faster!

No matter what type or size castings you make, whether your production is large or small, there's a ROTOBLAST *Table, Barrel, Table-Room* or *Room* especially designed to save you money. *Get all the facts.* Bulletin 214 tells the complete story, contains specifications and technical details. Write for your free copy today to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md.

MORE THAN 25,000 PANGBORN MACHINES SERVING INDUSTRY

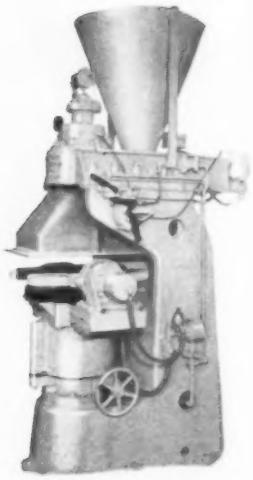
BLAST CLEANS CHEAPER

with the right equipment for every job



CB-400

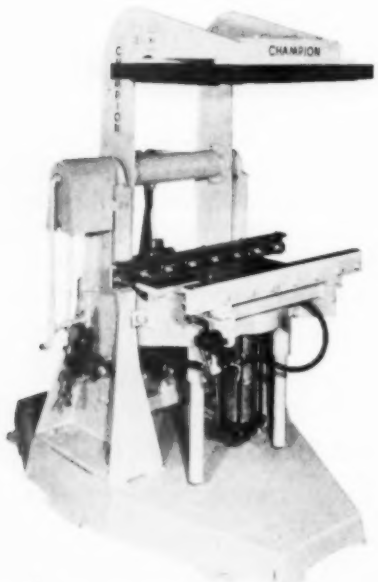
CB-18



CB-15

Winner... *and still*

The broad Champion line includes a core making or molding machine for practically any requirement of your production foundry. Rugged, simple and speedy, these machines are truly outstanding standards of efficiency and high production in the industry today. Available with automatic controls.



Champion CR Rollover

The newest addition to the Champion family, the Champion CR rollover and draw machine in combination with Champion Core Blowers make a winning high production team.

What are your Core or Molding Requirements?

A Champion production specialist can show you how Champion machines can fit into your foundry scheme to better your production quantity and quality at lower cost. Ask him to call on you today.

CB-12

CB-10

CB-5

Champion!

Champion Core Blowers score high with convention foundrymen

"You've done it again" was the word given us by you representative foundrymen at the Cleveland Convention in May. Not only were you enthusiastic about the advanced engineering features but you praised the utter simplicity in design and operation of these machines.

In fact your cast judgment of all the machines at the show boiled down to this:

Champion Core Blowers had MINIMUM operations
MINIMUM levers
MINIMUM hoses and pipes
MINIMUM effort in operating
MINIMUM air consumption
MINIMUM maintenance

adding up to MAXIMUM efficiency and production.

"Yes," you told us, "Champion retains the leadership in the field."

CHAMPION FOUNDRY AND MACHINE COMPANY

SALES OFFICE, 1553 W. MADISON STREET, CHICAGO 7, ILLINOIS
GENERAL OFFICE AND PLANT • ROCKFORD, ILLINOIS
EXPORT DEPT., 49th FL., WOOLWORTH BLDG., NEW YORK 7, N. Y.

MOLDING MACHINES CORE BLOWERS THE ELECTRIC RIDDLE

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BRAZIL
W. F. Guth Foundry Engineering, Caixa Postal 1411, Sao Paulo

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Mauricio Hochschild & Cia. Ltd., Casilla 153 D, Santiago, Chile

Newest Achievement in CARL-MAYER VERTICAL CORE OVENS

AND CONTINUOUS MONORAIL CORE OVENS

•

Carl-Mayer Vertical Core Ovens, with the heating system described, are protected by Patent No. 2,257,180. Other patents pending.

Vertical Ovens (Figs. 1 and 2) are by Carl-Mayer, using the universally adopted recirculating heating system with sealed combustion chamber located between conveyor chains.

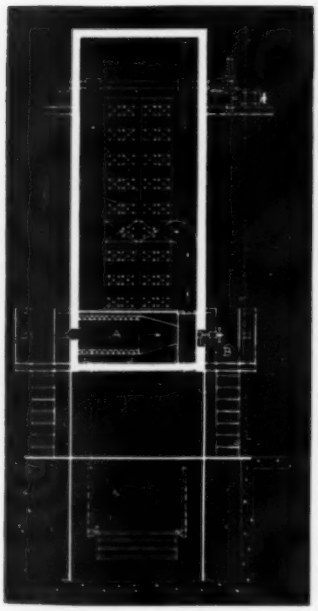


Fig. 1
NEW METHOD with heat fan inside oven.

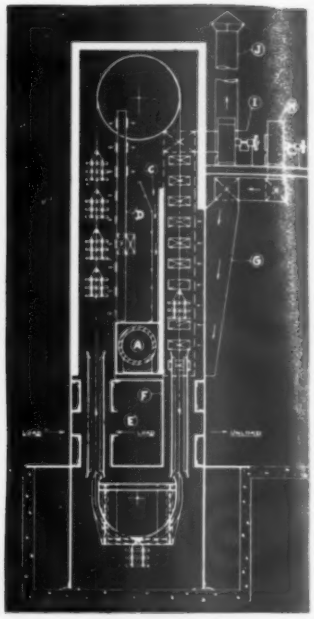


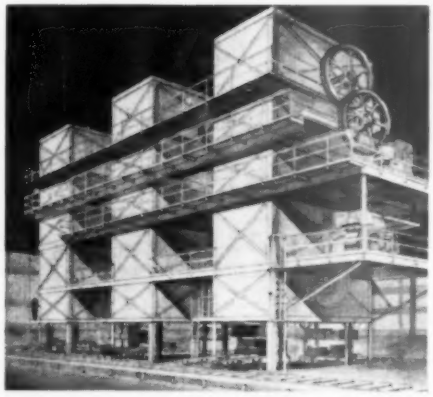
Fig. 2
Section showing conveyor travel thru pass, heating, cooling and exhaust system.

CONSIDER THIS HIGHLY IMPORTANT NEW DEVELOPMENT OF LOCATING THE HEAT FAN INSIDE OF OVEN (Fig. 1)

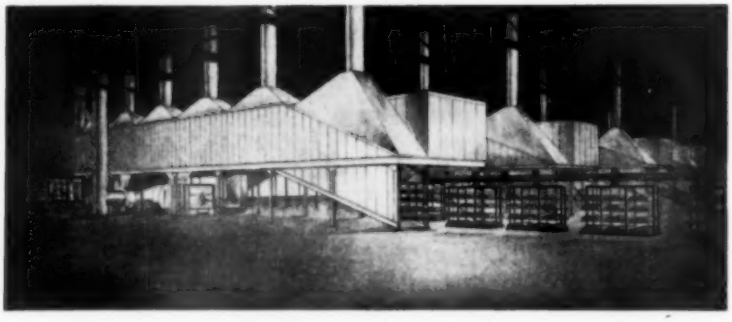
New added features are as follows:

(1) Saves platform space.
(2) Eliminating external duct reduces heat losses.
(3) Placing heat fan in oven also reduces heat losses, resulting in high operating efficiency.
(4) Elimination of external heat duct and fan insulation results in lower installation cost.
(5) Oven appearance is greatly improved and smoking eliminated from external heat ducts.

***Write for full description** of this and other vertical oven features guaranteeing faster baking, lower fuel consumption, smaller core losses, safer operation, **elimination** of smoke, **cooled** cores at unloading station, reduced labor cost.*



Three outstanding Carl-Mayer Vertical Ovens at General Steel Castings Corp. Each oven is 67′ high, 80 tons per bake per oven.



Carl-Mayer Continuous Monorail Core Ovens
Patent No. 2,355,814

One of the largest Monorail installations in the U. S. A. (patent no. 2,355,814) made for the Ford Motor Company. Each oven is 170′ long, utilizing 1,200 feet of continuous monorail conveyor. Some of the outstanding advantages of these ovens are:

(1) Flexibility in core handling, bench to core rack.
(2) Uniform, fast baking, using the "Mayer" convection heater.
(3) Cores can be removed with bare hands at unloading station using Carl-Mayer patented design.
(4) Smoke nuisance is eliminated.

Typical Users of CARL-MAYER VERTICAL AND MONORAIL OVENS

Aluminum Co. of America
Burt Foundry Co.
Cadillac Motor Co.
Eclipse Aviation Corp.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
General Motors Corp.
General Steel Castings Co.
Harrison Radiator Co.
Henry Kaiser
H. B. Salter Co.
McKinnon Industries
Quality Castings Co.
Packard Motor Co.
Richmond Radiator Co.
Union Brass and Metals Mfg. Co.
West Michigan Steel Castings Co.
A. C. Williams Co.

THE CARL-MAYER CORPORATION

3030 Euclid Ave., Cleveland, Ohio

Core and Mold Ovens—all types. Backed by over 30 years' experience

THE WESTINGHOUSE AIR BRAKE COMPANY
Photo Courtesy Mathews Conveyor Co.

This Foundry is *A Good Place to Work*

This railway supply manufacturing company was founded in 1869 and moved to Wilmerding, Pa., in 1890. Over this 81 year period of operation, it has been progressive, alert to modern production techniques, and a good place to work.

There are three foundries in operation—gray iron, brass and aluminum. Capacity, respectively, in the three plants is approximately 10,000 tons; 1,500,000 lbs.; and 100,000 lbs. per month.

Peak employment in this company approximates 7400, of which 1600 work in the foundries themselves.

Close attention has been paid to keeping it a good place to work through the use of up-to-date materials handling facilities, safety programs, good housekeeping methods including adequate ventilation and lighting apparatus—and Herman Molding Machines.

The 1500 lb. rollover capacity machine illustrated typifies the ruggedness, simplicity and automatic features of *all* Herman Machines, 750 to 40,000 lb. rollover capacity. They've made their way by the way they're made in the U. S. and 60 foreign countries.

Write for our new catalog.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Herman MOLDING MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

Compact Allis-Chalmers centrifugal cupola blower replaced bulky rotary positive type blower in this Milwaukee, Wis., foundry! Rated 4400 cfm at 1.5 lbs G, driven by an Allis-Chalmers induction motor. Notice light, simple foundation . . . compactness of out-of-the-way installation.

Air is the One Cupola Element You Can Control!

AIR WEIGHT AND VOLUME are the only factors in cupola operation that do not depend on the judgement of your cupola metallurgist! You get *complete* air regulation with Allis-Chalmers centrifugal blowers equipped with air weight control. They *automatically* deliver more or less air, as required, without the necessity of blowing off to atmosphere with subsequent power waste, as with positive pressure blowers.

With A-C blowers, a metered amount of oxygen enters the cupola; you get a uniform temperature and greater uniformity in composition of the metal.

You get these construction features in A-C blowers:

1. CLOSE COUPLED design makes them compact. Adapter piece of cast iron rigidly connects blower casting to motor frame.
2. CAST CASINGS give long life impossible with fabricated constructions. One piece cast inlet nozzle and cover facilitates inspection and cleaning.
3. ANTI-FRICTION BEARINGS support the one moving part, the impeller, usually "overhung" on motor shaft.

Specify A-C blowers for cupola installations and replacements. For more information call your nearby A-C Sales Office or write for Bulletin 16B6048.

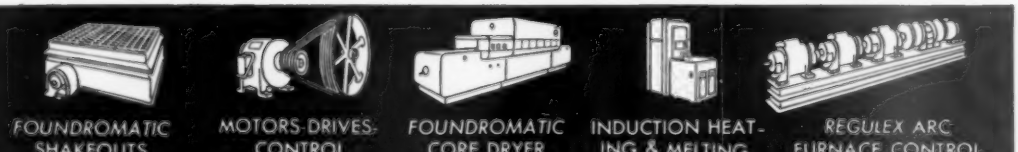
A-3054

ALLIS-CHALMERS, 1032A SO. 70 ST. MILWAUKEE, WIS.

Foundromatic and *Regulex* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Foundry Equipment for Bigger Output-Better Working Conditions!



Improve Parting... Production... Profits

READ the NEW Acheson bulletin on How to Use **"dag"** colloidal graphite in the Foundry. **"dag"** colloidal graphite gives better parting, better reproduction, smoother surfaces . . . prevents damage to castings and molds.

It assures less labor per piece, improves pouring and saves on material, extends life of molds and saves on investment, cuts rejects and increases your production.

Even metallurgical quality is improved, because **"dag"** colloidal graphite adsorbs oxidizing gases. It is immune to foundry temperatures, economical to use and, when dispersed in water, eliminates smoking.

The NEW Bulletin #425 gives instructions on the coating of permanent molds, cores, patterns, gates, runners, risers, pins, shoulder screws, ladles, and other foundry equipment. We'll be glad to send it . . . please fill out the coupon.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Foundry Bulletin #425

☐ Send an Acheson engineer

NAME.....

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G-14

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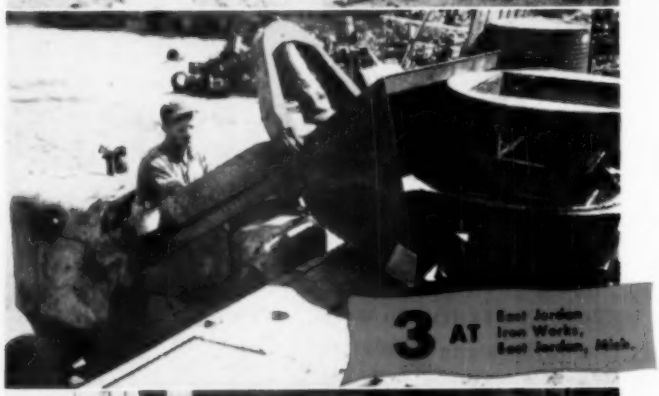
... also Acheson Colloids Limited, London, England

Proof of PAYLOADER Performance



Of the hundreds of PAYLOADERS in Foundries and Metal Working plants, many represent repeat orders . . . proof that Payloaders are paying their way with performance that cuts costs, saves time and money, and speeds production. One man on a PAYLOADER does a variety of jobs faster, easier and cheaper than a crew of men. A glance at the PAYLOADER jobs below will help you determine where these versatile tractor-shovels can improve your operations.

Here are Typical PAYLOADER Jobs

- Unload box cars.
- Carry sand, coke, scrap, limestone, etc., to storage.
- Transport materials to cupola.
- Transport and distribute sand to molding stations.
- Windrow sand for the cutter.
- Remove used sand from floors.
- Transport molten metal.
- Charge mullers, hoppers, tumbling barrels.
- Feed conveyors, elevators, mixers, screenerators.
- Remove cupola drops.
- Load trucks.
- Dispose of old sand, cores and other waste.
- Handle scrap and small castings.
- Clean up gangways, aisles and other areas.
- Load charge boxes.
- Load out trash, debris.
- Level dumps—dig and grade.
- Maintain private roadways.
- Handle coal, ashes, cinders.
- Do crane work—haul, push.
- Remove snow.

Get these helpful Job Studies that show and describe many actual PAYLOADER operations in a Foundry and in a Metal Working plant. There is no obligation. Simply write The Frank G. Hough Co., 703 Sunnyside Avenue, Libertyville, Illinois.

SAY "HUFF"

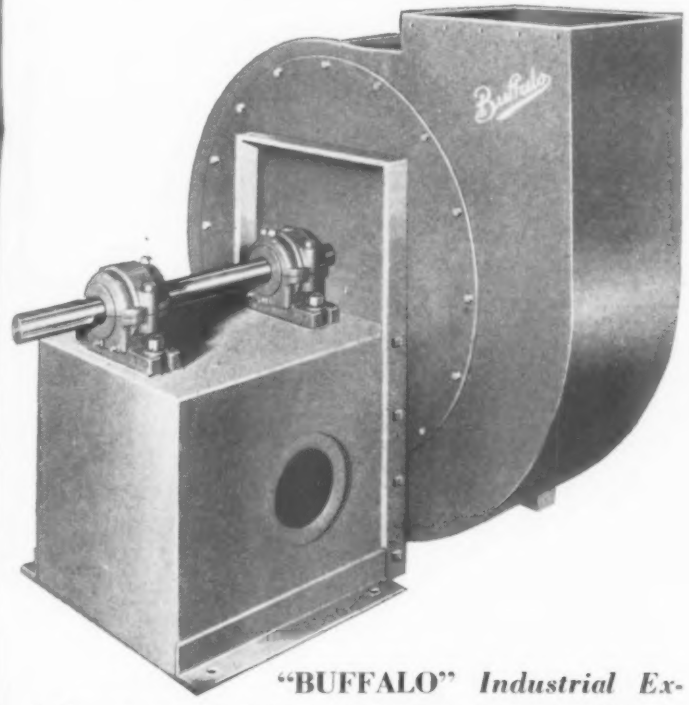
HOUGH PAYLOADER®

Manufactured by THE FRANK G. HOUGH CO.

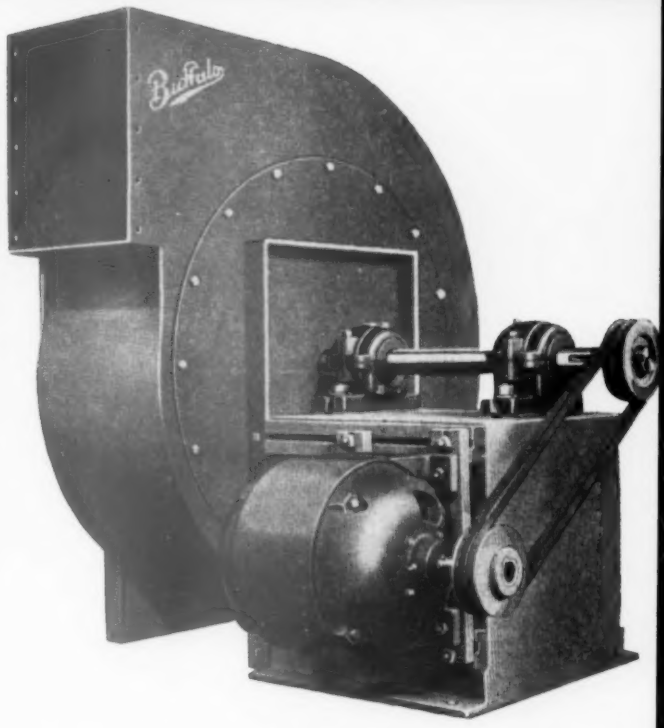
EXHAUST THE *AIR* YOU *DON'T* WANT

—WITH "BUFFALO" TYPE "AW" INDUSTRIAL EXHAUSTERS

● These all-welded steel plate fans are extremely rugged for heavy duty, and their smooth wheel and housing surfaces have no rivets to add to resistance. Housings of "Buffalo" Industrial Exhausters are readily adjustable to any desired discharge position. Models available for hot or corrosive gases. Type "AW" Wheels have blades shaped for high efficiencies.



"BUFFALO" *Industrial Exhauster with 6-bladed "MW" Material Wheel. Both "AW" and "MW" Wheels are interchangeable.*



"BUFFALO" *Industrial Exhausters are available in four arrangements, both belted and direct drive.*

MOVE MATERIALS ECONOMICALLY

—WITH "BUFFALO" TYPE "MW" INDUSTRIAL EXHAUSTERS

● If you can move it with a pneumatic system chances are "Buffalo" Industrial Exhausters are your cheapest method! Emery dust, chips, etc. handled efficiently. "MW" Wheels have rugged blades welded to back plate—will out-perform paddle wheel type wheels. WRITE FOR BULLETIN 3576-A for any exhausting problem you may have.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

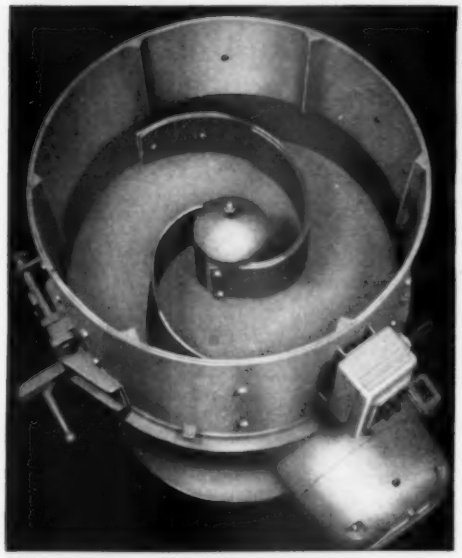
221 MORTIMER ST. BUFFALO, NEW YORK

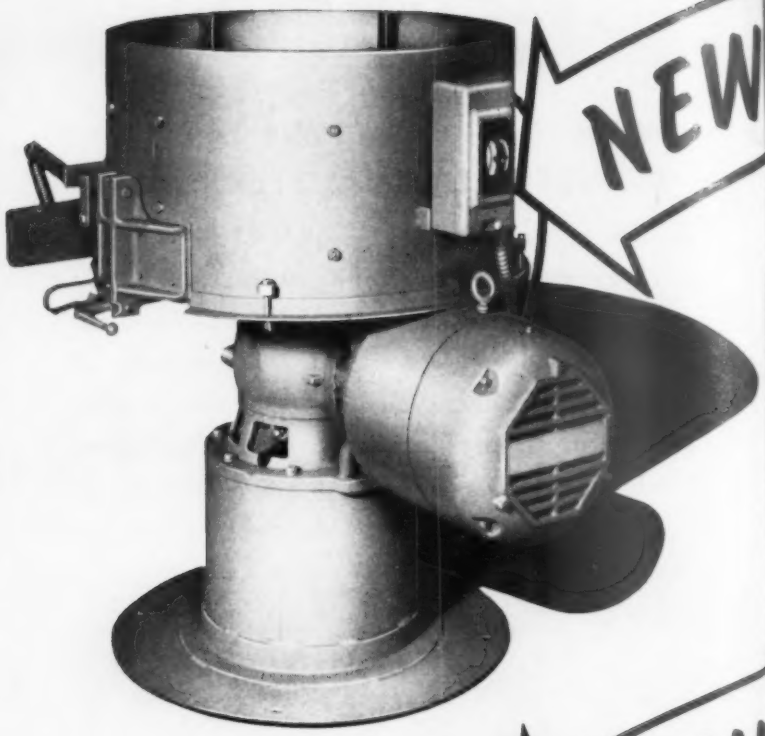
Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

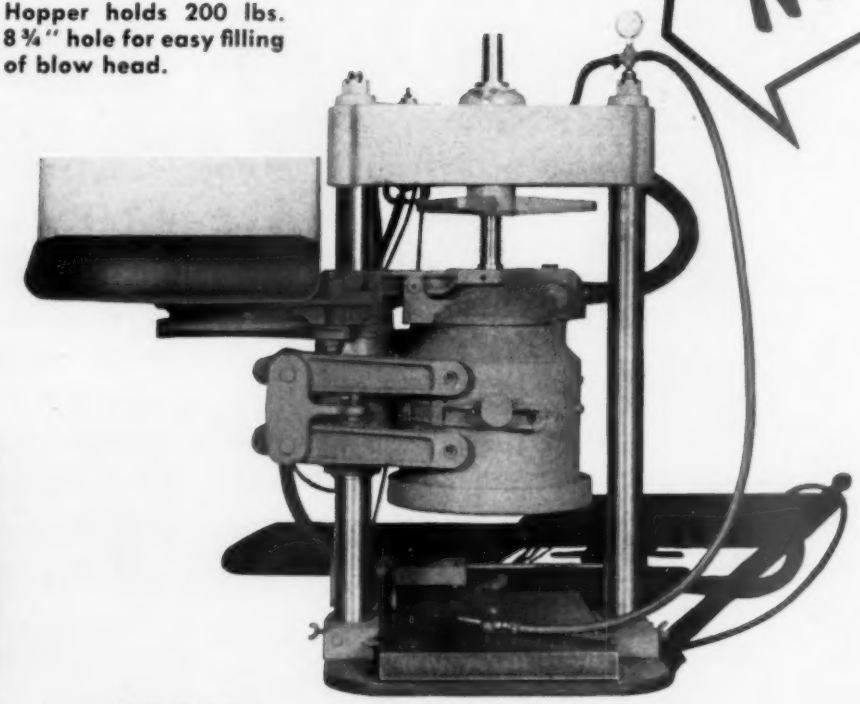
Batch size, 3 cubic feet. Discharge door is 28" above floor.

Two flexible, spring steel arms whirl the sand . . . no crushing of sand grains, no overheating.



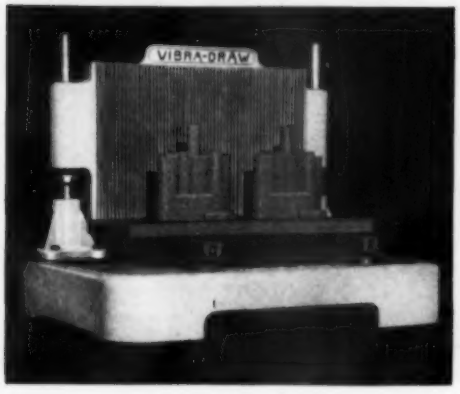


Hopper holds 200 lbs. 8¾" hole for easy filling of blow head.



"VIBRA-DRAW" CORE DRAWING MACHINE

Draws perfect cores as fast as "SAN-BLO" can make them. Simply place core box against vibrating head and lift box.



A perfect team for fast production!

WHIRLMIX Sand Mixer

Small, compact, easily moved!
Mixes 4,000 lbs. of sand per hour!

Here's a small mixer, but a big producer! It does a real job of mixing oil sand, dry core compound or facing sand, and produces a fluffy, aerated sand. The flexible, whirling arms rub and squeeze the materials with a constant pressure that mixes thoroughly, but does not overheat the sand, or crush sand grains. WHIRLMIX is a compact unit, weighs but 1060 lbs., and doesn't need a foundation. Can be moved easily by crane or lift truck, from one location to another.

ALL-PURPOSE SAN-BLO Sand Blower

Blows any type core sand, with green strength up to 8 lbs., moisture to 8%

A revolutionary new design blow head gives SAN-BLO a versatility possessed by no other core blower. Air is introduced around the lower section of blow head, where the sand is agitated by motor-driven plows. Thus, the sand is first thoroughly mixed with air, then fed toward the single 1" hole in blow plate, through which it is carried in a stream of air into the core box. Sand is truly "blown" into box, rather than compressed and forced through small holes. As a result, SAN-BLO successfully blows even dry core compound, and sands of high green strength and moisture content.

Other Advantages

Blows single cores up to 40 lbs. each, or 40 lbs. of small cores, without refilling or moving blow head—and blows them all through one universal blow plate. Any type core box can be used—up to 18" wide, 24" long, 12" high. One simple adjustment to change boxes—a single valve controls clamping and blowing.

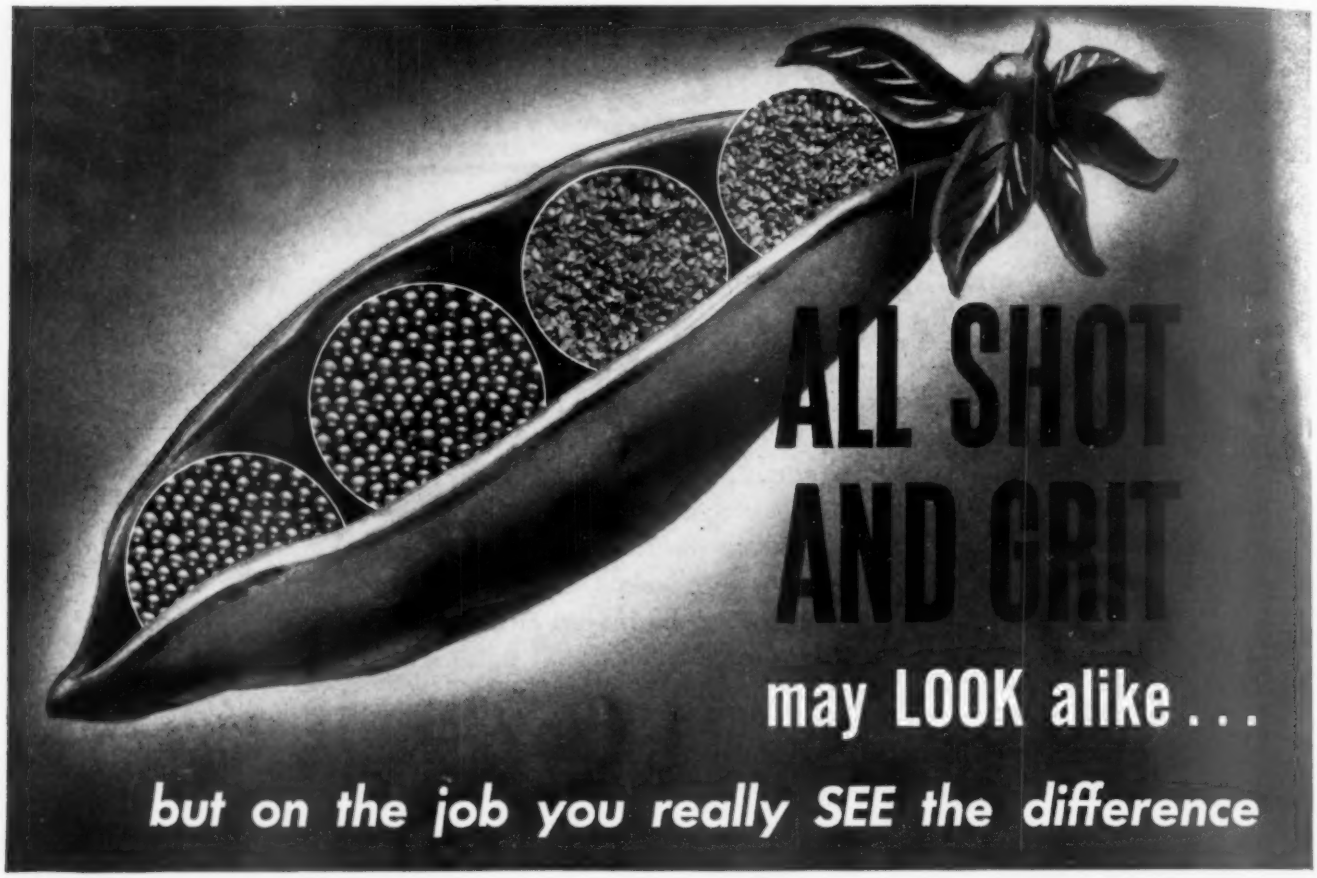
Call your FEDERAL representative or write direct for full information on WHIRLMIX and SAN-BLO machines.

THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 East 71st Street • Cleveland 5, Ohio

CHICAGO LOS ANGELES DETROIT MILWAUKEE RICHMOND, VA. ST. LOUIS
CHATTANOOGA MINNEAPOLIS NEW YORK CROWN HILL, W. VA. UPTON, WYO.

DETROIT PUBLIC LIBRARY



TO ALL outward appearances any two grades of shot or grit may appear to be as much alike as peas in a pod—but there the similarity ends. Rarely do they perform alike.

In using HI-GRADE Shot and Grit you'll find there IS a difference . . . a recognizable value far beyond purchase price that shows up in extra performance on the job.

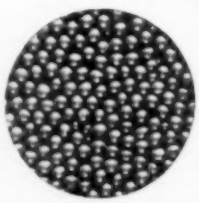
Though you may be satisfied with the material you are now using, it is just good business not to deny the promise of uniform, lower cost, more efficient blast-cleaning which HI-GRADE Shot and Grit can fulfill for you.

You can't be blamed for wanting longer use-life in the abrasives you use—more efficient cleaning and peening—a better finish in less time. Get these advantages with HI-GRADE Shot and Grit. Requisition a trial quantity today. You'll never regret it.

Packed in 100 lb. Bags—Ready for Immediate Shipment

METALLIC

SHOT **HI-GRADE** GRIT



HI-GRADE SHOT
UNIFORM SIZE AND HARDNESS
Withstands repeated strain, stress and wear. Exclusive alloying and tempering process helps prevent rust; minimizes impact fractures.

HI-GRADE GRIT
SHARP, TOUGH AND DURABLE
Made of same material and processed by same methods as Hi-Grade Shot. Cleans with maximum efficiency. Reduces equipment wear and maintenance costs.

HI-GRADE SHOT AND GRIT MORE THAN MEETS S.A.E. SPECIFICATIONS—SCREENED AND GRADED FOR 100% USAGE

Clayton-Sherman *Abrasives Company*

MANUFACTURERS OF *QUALITY-CONTROLLED* SHOT AND GRIT

Representatives in Principal Cities

3896 LONYO ROAD ★ DETROIT 10, MICHIGAN

"HIGH SPOT" OF 1950 FOUNDRY SHOW

Means More Profits To You

A crowd-collecting feature of the recent Foundry Show was the demonstration of the Croning Process in Bakelite's Exhibit. This new process for making foundry molds and cores combines the advantages of increased production, reduced cost, and improved quality of the casting. It uses BAKELITE Phenolic Resins as binders for the foundry sand. Crown Casting Associates, 75 Federal St., Boston, own and control U. S. and Canadian patent applications for the process and are granting licenses to users.

These are some of the advantages of the process: Clean, smooth castings are produced which require little or no finishing such as shot-blasting or other abrading; tolerances of .002 to .003 of an inch are common practice; floor space productivity is greatly increased.

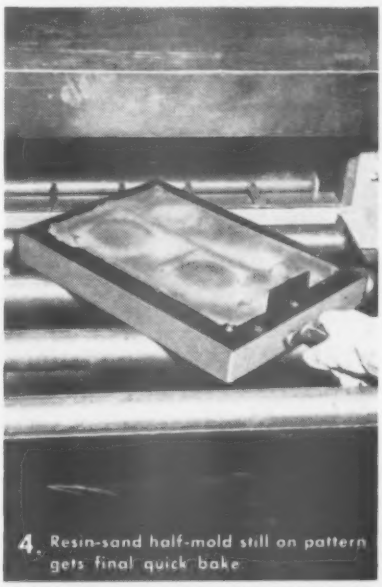
Because Croning Process molds and cores are strong, although thin-walled shells, they provide a saving of up to 90 per cent in the amount of sand that would be required for heavy conventional sand molds and cores. BAKELITE Phenolic Resin bond contributes the necessary strength and moisture resistance to permit storage of molds and cores for future production. Baking of these molds and cores requires only a few minutes, not hours.

It will pay you to write today to Dept. AT-29.

1. Pouring BAKELITE Resin-sand mixture into mold-making machine.

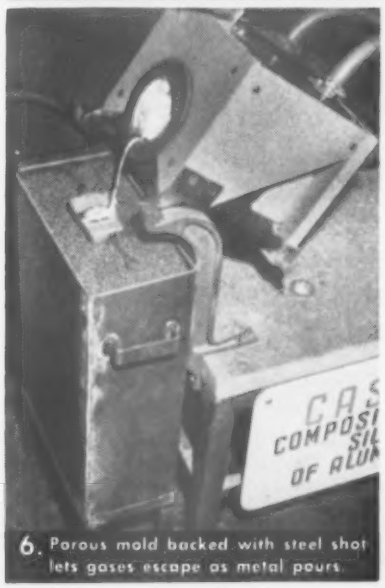
2. Hot pattern is clamped on face of mold-making machine.

3. Machine inverted: mixture fuses into thin half-mold on pattern.



4. Resin-sand half-mold still on pattern gets final quick bake.

5. Two thin half-molds clamped together form finished mold.



6. Porous mold backed with steel shot lets gases escape as metal pours.

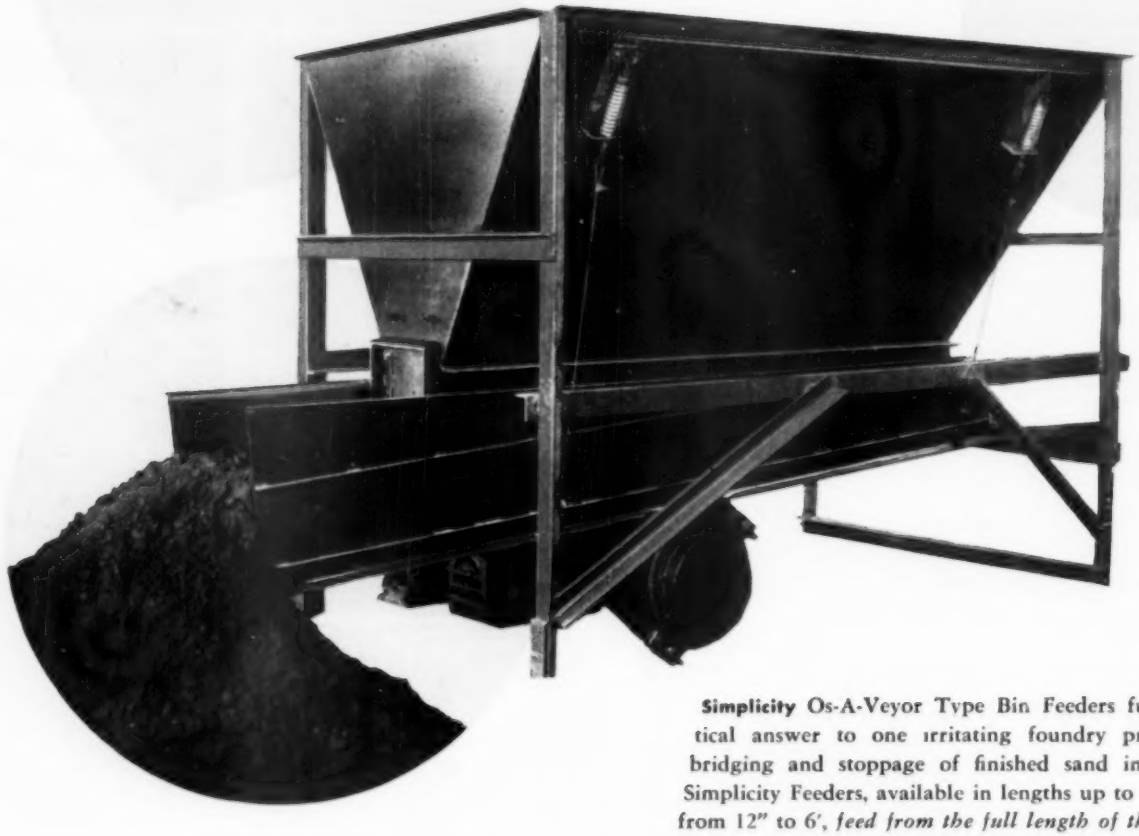
7. Mold is easily broken away, leaving casting free of sand.

Bakelite TRADE-MARK *Phenolic* **BONDING RESINS**

REG. U.S. PAT. OFF. BAKELITE DIVISION UCC

BAKELITE DIVISION
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

SIMPLICITY OS-A-VEYOR BIN FEEDER REDUCES BRIDGING AND STOPPAGE



2' x 10' two-surface Os-A-Veyor Type Feeder Installed Under Test Bin.

Simplicity Os-A-Veyor Type Bin Feeders furnish a practical answer to one irritating foundry problem . . . bridging and stoppage of finished sand in storage bins. Simplicity Feeders, available in lengths up to 50' and widths from 12" to 6', *feed from the full length of the bin* with the danger of bridging and hanging greatly reduced. Sand also can temper in the bin with exact length of time dependent on capacity of bin and rate of feed. ✓ ✓ ✓ In actual operations, a 3' x 17' two-surface Simplicity Bin Feeder installed at the Buick foundry, Flint, Michigan, handles, *at a uniform controlled rate,* 100 tons per hour of finished, mulled and tempered sand feeding from a 150 ton capacity bin through a 14' long opening. In this operation, the sand is allowed to temper for 1½ hours before going to the molders. Greater capacities are readily possible if required. ✓ ✓ ✓ Why not investigate Simplicity Os-A-Veyor type bin feeders for your foundry . . . *it'll mean money saved.* A Simplicity sales engineer will be glad to give you the full story on the remarkable new development. 34

Sales representatives in all parts of the U.S.A.

FOR CANADA: Canadian Bridge Engineering Co., Ltd., Walkerville, Ontario.

FOR EXPORT: Brown & Sites, 50 Church St., New York 7, N. Y.

implicity
TRADE MARK REGISTERED

ENGINEERING CO. • DURAND, MICHIGAN

SHAKES OUT FIVE FLASKS IN ONE OPERATION!

PRODUCTION DOWNTIME IS MINIMIZED at the Continental Foundry and Machine company, East Chicago, Illinois, with this 8' x 10' twenty-five ton capacity *Foundromatic* shakeout. Continuous jobbing foundry operations handling castings up to 12 tons require the dependability of Allis-Chalmers shakeouts.

The load on the *Foundromatic* two-bearing shakeout is not limited by the shaft diameter or the size of the bearings. Entire load, plus the shakeout weight, is carried on support springs . . . giving long bearing life . . . preventing shaft failure.

Over 90% of the shakeout is isolated from the foundation by the support springs. Long spring life is obtained because bumper guides prevent over-stressing of the support springs.

Your requirements can be met by one of the nine sizes from 3' x 5' with capacity of one ton, to 8' x 10' with capacity of 25 tons. Multiple units can be supplied with capacities over 100 tons.

Call your nearby A-C Sales Office for information, or write for Bulletin 07B6365A. A-3014

ALLIS-CHALMERS, 1032A SO. 70 ST.
MILWAUKEE, WIS.

Foundromatic and *Regulex* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Foundry Equipment for Bigger Output-Better Working Conditions!

TO IRON OUT FOUNDRY PROBLEMS...

Add Professional Engineers to your Staff

for Valuable Temporary Service

KNIGHT Services For Foundries:

- Foundry Engineering
- Architectural Planning
- Foundry Layout
- Foundry Modernization
- Foundry Management
- Industrial Engineering; Job Evaluation, Incentives
- Production and Cost Control

Knight Engineers are professional foundry specialists whose only interest is to help solve your problems to best advantage — at lowest cost — in the shortest time.

These engineers, with 10 to 25 years of successful experience in foundry management, production, engineering or equipment, are exceptionally well qualified to offer you valuable service to insure greater production, lower costs and better profits.

They don't know all the answers, of course, but, Knight Engineers with their broad experience combined with the detailed knowledge of the client's staff develop a better solution to the problem* than either group separately.

Regardless of your problem — large or small — it will pay you to take advantage of Knight professional engineering service. Call or write us today.

* A partial list of successful projects engineered by Knight furnished at your request for reference.

Send for New Bulletin . . .

Descriptive booklet, "Professional Foundry Engineering" outlines Knight services for foundries. Send for your copy.

LESTER B. KNIGHT & ASSOCIATES INC.

· *Consulting* Engineers ·

600 W. JACKSON BLVD.
CHICAGO 6, ILLINOIS

30 CHURCH STREET
NEW YORK 7, NEW YORK

CONSULTING SERVICE
for Management · Sales · Production

ENGINEERING SERVICE
for Surveys · Modernization · Mechanization

THESE TESTS PROVE Malleabrasive CUTS CLEANING COSTS up to 50% and more!

Results of four recent Malleabrasive tests conducted independently by four typical foundries.

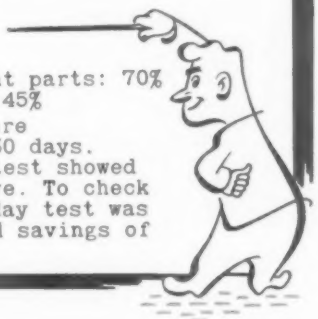
TEST #1

Made by: Cortland Forging Division of Brewer-Titchener Corp.
Total savings with Malleabrasive:

57.2%

Savings on replacement parts: 70%
Savings on abrasive: 45%

Remarks: Two tests were conducted, each for 30 days. Result of the first test showed 35% saving on abrasive. To check results a second 30-day test was run. This test showed savings of 45% on abrasive.



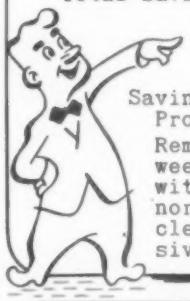
TEST #2

Made by: Reading Gray Iron Castings, Inc.
Total savings with Malleabrasive:

51.8%

Savings on replacement parts: 64.7%.
Production increased: 25.4%.

Remarks: Test was run for seven weeks. Malleabrasive was compared with standard quality abrasive normally used for this type of cleaning. Test also showed abrasive handling cut by ½.



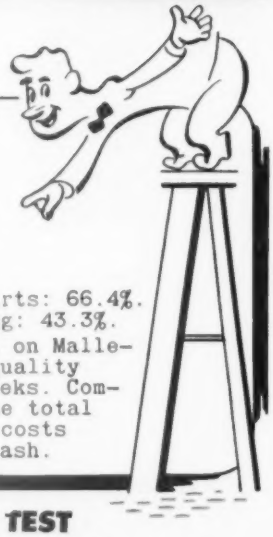
TEST #3

Made by: Crucible Steel Castings Co.
Total savings with Malleabrasive:

35.9%

Savings on replacement parts: 66.4%.
Saved on abrasive handling: 43.3%.

Remarks: Comparative test on Malleabrasive and a standard quality shot was run for seven weeks. Computed on a cash basis, the total 35.9% saving on cleaning costs adds up to $5,283.20 in cash.



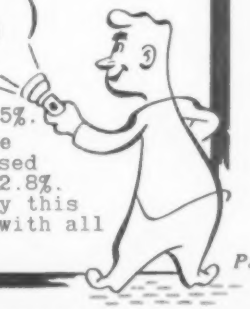
TEST #4

Made by: Ohio Forge & Machine Corp.
Total savings with Malleabrasive:

58.9%

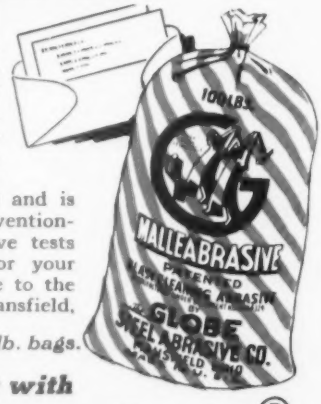
Saved on replacement parts: 81.3%.
Saved on abrasive cost: 43.5%.

Remarks: Using Malleabrasive in the cleaning room increased this foundry's production 12.8%. The comparative test held by this company lasted seven weeks, with all costs carefully recorded.



MAKE THIS AMAZING TEST IN YOUR PLANT!

Comparative tests prove Malleabrasive saves from $500 to $2000 per machine *each year!* We'll send you all the data to make your own test. Remember, Malleabrasive has been tested, accepted and uesd for more than *10 years* and is *guaranteed* to outperform conventional abrasives when comparative tests are properly made. Send for your TEST KIT today! Just write to the Globe Steel Abrasives Co., Mansfield, Ohio.



Packed in new orange striped 100 lb. bags.

Save on blast cleaning with

†U.S. Patent #2184926
(other patents pending)

PATENTED†

Malleabrasive®

THE GLOBE STEEL ABRASIVE CO., MANSFIELD, OHIO

· *MANUFACTURERS OF METAL ABRASIVES SINCE 1907* ·

For Foundry Economy — NORBIDE® Nozzles
Iron nozzle stream at start
Same nozzle after 3 hours
Norbide nozzle after 404 hours

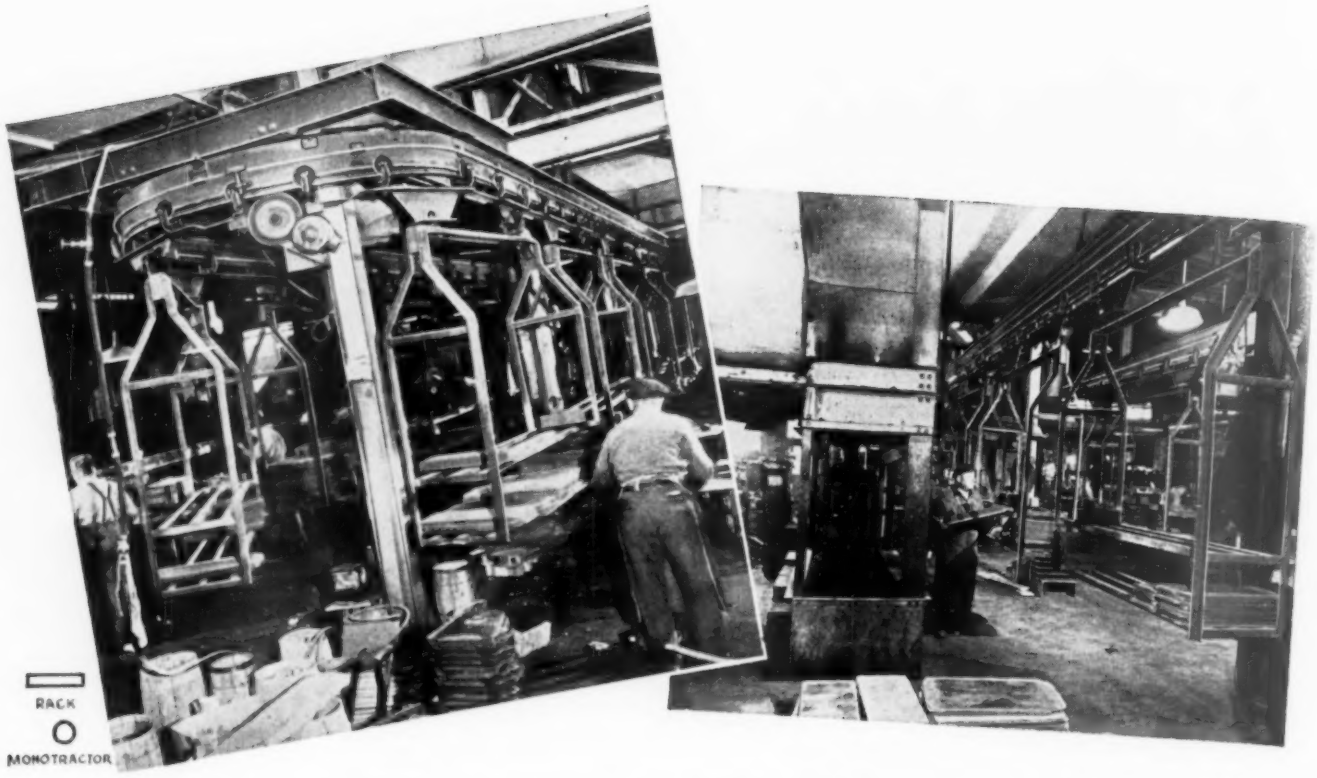
NORBIDE Nozzles for Pressure Blasting

NORBIDE Nozzles are recommended for foundry use because they will outwear conventional types of nozzles thousands of times.

Made of Norton Boron Carbide — the hardest material manufactured for commercial use — NORBIDE Nozzles will last for weeks and months where ordinary nozzles wear out in hours. The result is that NORBIDE Nozzles give more service per dollar cost than any other nozzle (the guaranteed minimum service is 750 hours with silica sand), they decrease air consumption 10% to 20% as compared with iron nozzles, and they maintain a stream contour and abrasive velocity which improves blasting efficiency.

The great wear-resistance of NORBIDE Nozzles enables them to retain almost peak efficiency for a long time. The time lost by nozzle changes is saved. Production increases follow.

NORTON NORTON COMPANY • Worcester 6, Mass.



7 years of uninterrupted Service

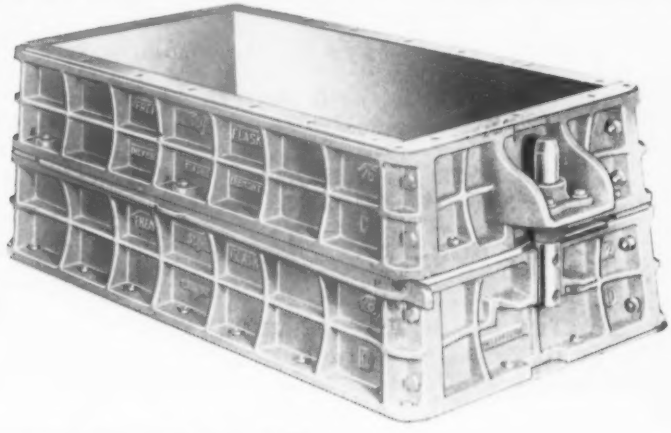
This American MonoRail overhead core handling system travels 15 feet per minute, and has been in continuous operation for over seven years. There has never been any "down time" caused by this system. Six pull and six push core carriers travel smoothly and automatically by an American MonoRail MonoTractor around a 90 foot loop of track from core benches to core ovens, and provide careful and efficient handling of all types of cores. This is just one of many time and money saving applications of American Mono-Rail systems in Foundry operations. Let an American MonoRail engineer show you how it can be done in your foundry.

THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE **CLEVELAND 7, OHIO**

Wells Mfg. Co.'s new foundry in Skokie, Ill. Its 28,800 sq. ft. of floor is well covered by Fremont cast iron jackets and magnesium flasks. They're standard equipment.

FREMONT
CAST IRON JACKETS



FREMONT
MAGNESIUM FLASKS

BUILT FOR LONG SERVICE & FAST PRODUCTION

ALL ORDERS GIVEN VERY PROMPT ATTENTION

GROOVLOCK
THE FOOL-PROOF PIN

THE FREMONT FLASK CO.
Fremont, Ohio

New.... Improved

DELTA CORE & MOLD WASHES

SPEED PRODUCTION OF BETTER, CLEANER CASTINGS AT *Lower Cost*

Three easy-to-understand reasons why more foundries use DELTA Core and Mold Washes . . .

1. **MORE PERFECT CASTINGS . . .**
2. **LOWER CLEANING ROOM COSTS . . .**
3. **LESS SCRAP IN MACHINING.**

DELTA CORE AND MOLD WASH-BASE
Mix with silica flour and water to produce finished wash.

•

FOR STEEL
STEELKOAT — Special Core and Mold Wash.

•

FOR GRAY IRON AND MALLEABLE
Grakoat — Blackoat — Hi-temp.

•

FOR GRAY IRON
Blackoat S-5 — A new and different wash.

•

FOR NON-FERROUS METALS
Non-FerrusKoat.

•

FOR ALL SAND CAST METALS
THERMOKOAT — It's Plasti-Lastic.
PYROKOAT-HI-Speed.

•

FOR UNUSUALLY HIGH TEMPERATURE CONDITIONS
Z-KOAT — High-fusion-temp. Wash.

•

There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

NEW mechanical processing and improved chemical formulation . . . developed by DELTA Research . . . have resulted in many decided advancements in both the quality and characteristics of DELTA CORE and MOLD WASHES.

Maximum uniformity of surface coverage is obtained with lower Beaume mixes, using more water. Penetration characteristics are THREE times greater (from 10 to 12 grains deep) and the density of the wash on the surface has been increased 40%.

Due to increased surface density the rate heat conductivity is speeded up and metal in contact with the washed surfaces cools more rapidly, resulting in smoother casting finish.

HERE'S WHY

a. Delta Core and Mold Washes "Anchor" themselves by penetrating from 10 to 12 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

b. The hot strength of Delta Core and Mold Washes increases with each degree of temperature rise from 1800°F to 3000°F providing maximum critical hot strength for all foundry applications.

The higher hot strength of DELTA Core and Mold Washes eliminates surface sand fissuring, excessive sand expansion and distortion.

c. No gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only Delta Core and Mold Washes provide this unique and all-important insurance against defective castings resulting from core gas leakage. DELTA Core and Mold Washes insure more perfect castings with finer finished surfaces.

● *Ask for a liberal working sample. You will also receive complete data on how to use DELTA Core and Mold Washes in your foundry.*

DELTA OIL PRODUCTS CO.

MILWAUKEE 9, WISCONSIN

Rewarding work!

NI-ROD saves iron castings...makes *machinable* welds

But for Ni-Rod electrodes, this pump body would have been scrapped at the foundry. The built-up area of the flange facing is almost indistinguishable from the original cast iron. Machining, drilling and tapping of the Ni-Rod weld deposit were no more difficult than similar operations in cast iron.

In the photograph above, you see a 45-pound gray iron pump casing that was rejected because a small area of the flange failed to fill during pouring.

Instead of being scrapped, the casting was sent to the plant's welding department. There, with Ni-Rod® electrodes, the defective flange was built up and the repaired casting was passed to the machine shop where it was finished like a regular production piece.

Salvage operations like this with Ni-Rod save time and money.

Ni-Rod gives fast, crack-free, non-porous welds that are a close color match for gray iron . . . and welds that are as *machinable* as the iron itself. Slag removal is easy. And Ni-Rod is stable-arcing in all positions with either AC or DC current.

Another important Ni-Rod feature . . . preheating or post-heating is seldom necessary.

Why not try Ni-Rod in your own shop . . . soon? Discover for yourself why *4 out of 5 shops* re-order Ni-Rod, once they've tried it.

Your nearest INCO distributor stocks Ni-Rod in 3/32", 1/8", 5/32", and 3/16" diameters.

FREE — 8-page booklet:
"NI-ROD . . . a new electrode for any cast iron welding."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

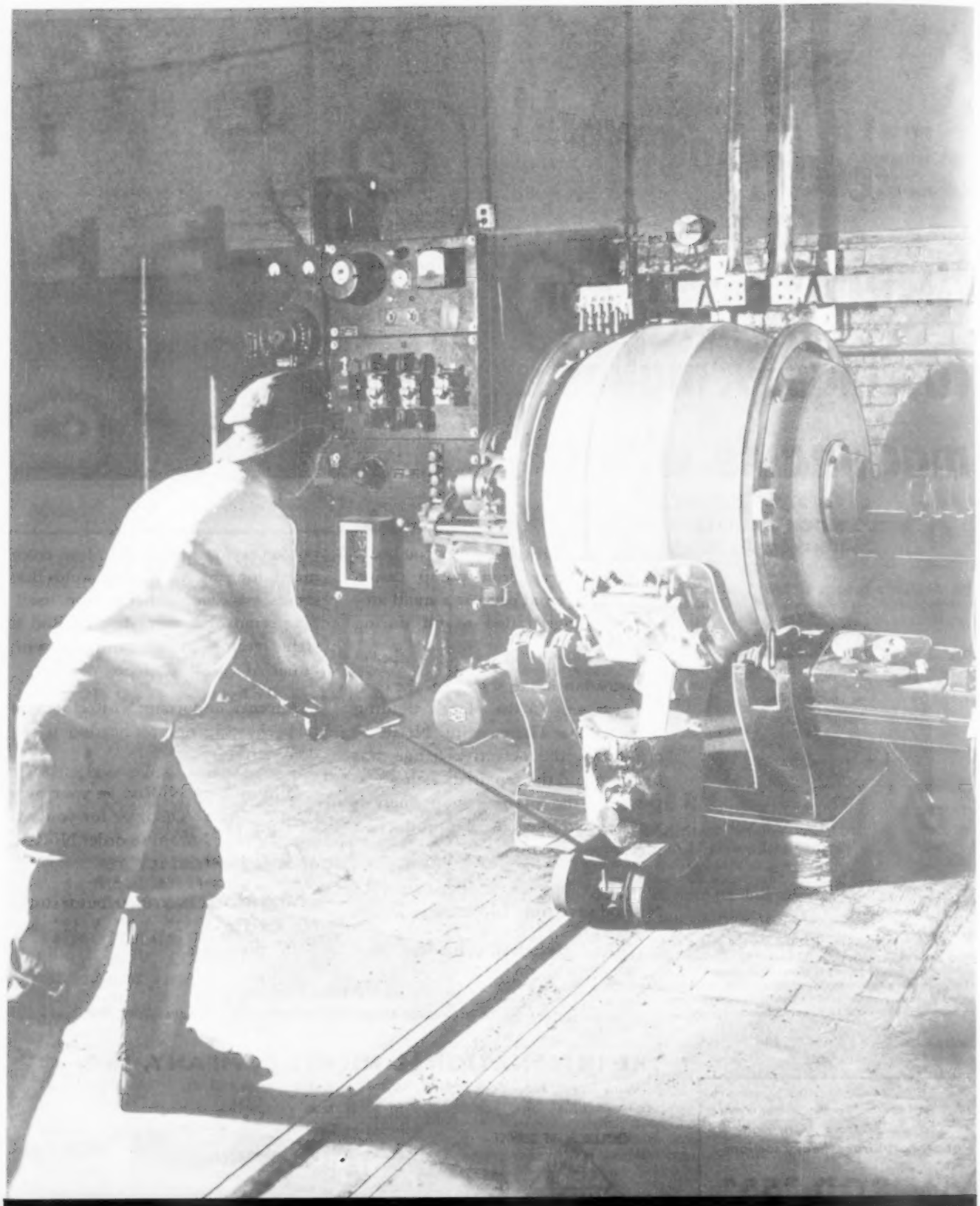
For welds you've never been able to make before . . . in high-phosphorus irons; heavy sections—

NI-ROD "55"

EMBLEM OF SERVICE
INCO NI-ROD
TRADE MARK

NI-ROD DISTRIBUTORS

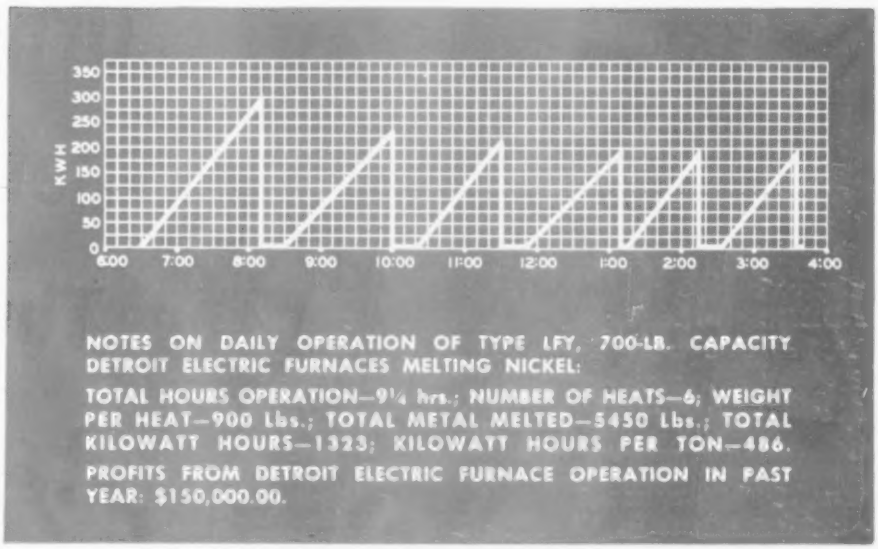
Alloy Metal Sales, Ltd.	J. M. Tull Metal & Supply Company	Whitehead Metal Products Company, Inc.
Robert W. Bartram, Ltd.		
Eagle Metals Company	Pacific Metals Company, Ltd.	Wilkinson Company, Ltd.
Metal Goods Corporation	Steel Sales Corporation	Williams and Company
Metal & Thermit Corporation	**National Cylinder Gas Company**	**Hollup Corporation**



Low MELTING COST *High* QUALITY CONTROL
FOR FERROUS *and* NON-FERROUS METALS

$150,000 PROFITS

FROM ONE YEAR OF DETROIT ROCKING ELECTRIC FURNACE OPERATION



A large automotive plant did it! Actually racked up $150,000 profits on Detroit Rocking Electric Furnaces in a year's operation.

The same operating advantages that set this outstanding record will work for you, too, when you put Detroit Rocking Electric Furnaces on your metal melting operations.

What Rocking Does

The rocking action of Detroit Electric Furnaces contributes heavily to superior performance. Electrodes remain clear of the molten bath at all times, eliminating the possibility of carbon pickup. The rocking movement stirs the bath constantly and assures complete homogeneity of the melt. It aids efficiency, too, because the metal picks up additional heat as it washes over the refractory lining.

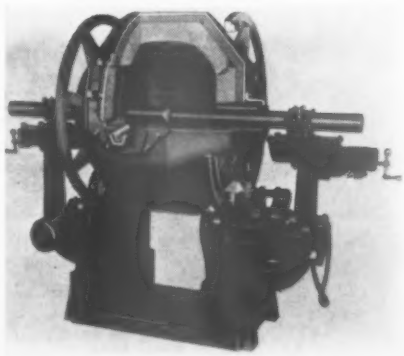
Profit-Producers

More heats per day because of faster melting speed, easier handling, positive control, minimum out-of-production time.

Maximum uniformity of product assures better quality of castings, higher usable yield per melt, fewer rejected castings.

Detroit Rocking Electric Furnaces achieve lowest metal loss by shrinkage, convert shop borings and turnings with least loss from oxidation.

Optimum power use makes for melting economy, and all-electric operation cancels the need for costly handling and storage of bulky fuels.



Full Range of Capacities

Detroit Electric Furnaces are available in capacities from 10 to 4000 lbs with either conical or cylindrical chambers. Furnaces are individually designed to meet your plant electrical specifications.

Get the Facts!

If you melt ferrous or non-ferrous metals, get the details on Detroit Rocking Electric Furnaces. Send us your production data and our engineers will furnish facts on high operating economy, positive quality control and other advantages *for you* in the Detroit Rocking Electric Furnace suited to your needs. Write to

DETROIT ELECTRIC FURNACE DIVISION
KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

ARCHITECTS AND BUILDERS AGREE

Bronze Ornaments Retain Their Lasting Beauty!

The beauty of Brass or Bronze ornamental works is inherent in the metal from which it is cast. The architect and builder know that there is no substitute for Bronze when lasting beauty is essential.

Specify— LAVIN NON-FERROUS INGOT—*Quality*

R. LAVIN & SONS, INC.

Refiners of Brass, Bronze and Aluminum

3426 SOUTH KEDZIE AVENUE · CHICAGO 23, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

He took a new look and MADE a MILLION!

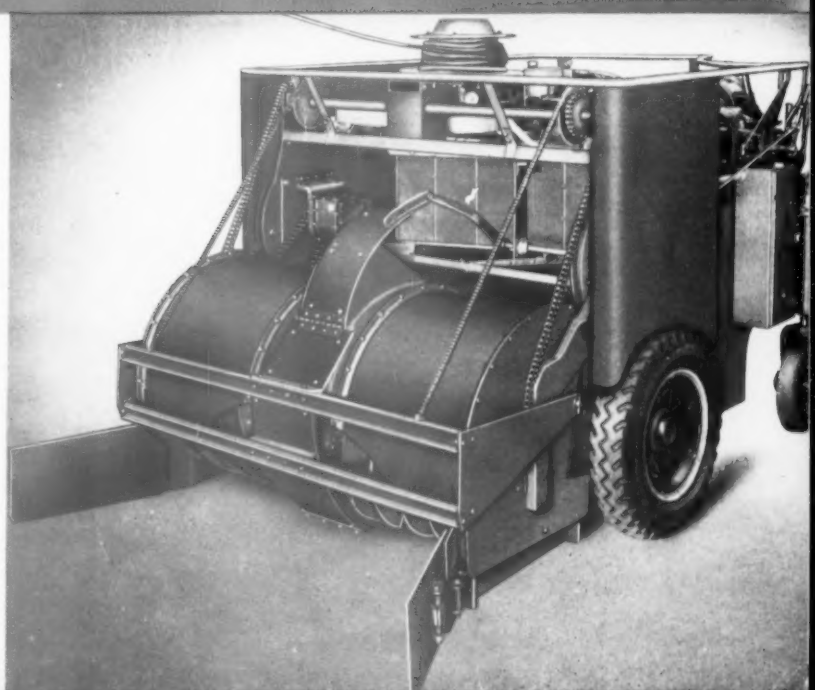
Once upon a time a man took a new look at a hairpin and invented the paper clip. The idea brought him a million dollars! Years ago in the steel industry Bill Jones took a new look at a rubber hose. The hose was not strong enough and was constantly bursting. So Bill "armor-plated" the hose by wrapping wire around it . . . a fresh approach that paid off. When you are ready to take a new look at your cleaning, dust control, and sand conditioning problems let us take a look, too . . . the result should be as rewarding as it has been to others in your field who have capitalized on our 'know how' and broad experience.

The NEW *American* SANDMASTER

FAST, COMPLETE SAND CONDITIONING CREATES BIG SAVINGS

- Operations:
  (1) Cutting (3) Screening
  (2) Magnetic Separation (4) Piling
- Self Propelled: gas or electric drive
- Variable Speeds
  — Cutting and Screening . . . 4′ to 25′ per minute
  — Piling or Traveling from floor to floor . . . 25′ or 100′ per minute
- Easily Maneuvered
- Hydraulic Steering
- Mulling action provides better sand
- Permits recutting before piling for proper tempering and blending
- Complete aeration and cooling
- Conditions synthetic sands quickly and with less bond additions
- Gives sand the "Velvet Feel" your molders will appreciate

Write For Bulletin No. 45



SAND CONDITIONING HEADQUARTERS FOR 43 YEARS

American WHEELABRATOR & EQUIPMENT CORP.
505 S. BYRKIT ST. MISHAWAKA 2, INDIANA

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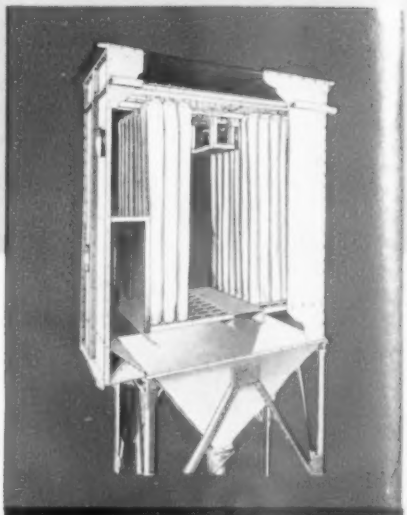
DUSTUBE *Saves*

MAINTENANCE TIME and OPERATING COSTS

THE LIBERTY FOUNDRIES CO.
Div. of Burd Piston Ring Co.
Rockford, Illinois



DUSTUBE ADVANTAGES

BETTER DUST REMOVAL — Simple, fast, thorough. Shortens cleaning time.

POWER SAVINGS — Lower resistance to air flow. Lower air velocities.

HIGH EFFICIENCY — Nearly 100% efficient by convincing tests.

EASE OF INSPECTION — Clean, safe, simple. No parts to remove.

LESS FILTER WEAR — No abrading metal contact. Easy to ship, store and handle.

FASTER FILTER REPLACEMENT—Takes only a few seconds. Requires no tools.

"Dust Count Is One of Lowest In the State"

"The state health department recently made a dust count in our foundry and reported that we had one of the lowest counts of all foundries in the State. We are proud of this recognition and must give a great deal of credit to the efficient operation of the Dustube Collectors used for ventilating our heavy dust creating processes. The way they eliminated our dust problems convinced us that "It pays to own a Dustube".

— Mr. Lawrence Perry, Fdry. Supt.

"Maintenance is Easy and Inexpensive"

"With the three Dustube Collectors, each operating under severe conditions, we have had exceptionally little maintenance to date. Periodic inspections are simple — all working parts are easily accessible — in a few minutes the job is finished. When it is necessary to change a cloth tube no special tools are needed and it is done on the clean air side. The automatic and efficient shaking of the tubes thoroughly removes all dust without any cloth wear. From a maintenance standpoint at least we consider the Dustube to be tops."

— Mr. Cecil Stevenson, Maint. Supt.

"Dustubes are A Profitable Investment"

"From a managerial standpoint, the Dustube Collectors have been a profitable investment for numerous reasons: (1) Profit margins are greater as the Dustubes cost less to operate and maintain; (2) Improved working conditions — the Dustubes effectively prevent all dust from permeating the atmosphere making our foundry a better place in which to work; (3) Community relations — dust which had formerly been exhausted into the neighborhood is now controlled and collected."

— Mr. C. M. Dale, Vice. Pres.

PLEASE TURN PAGE

MANUFACTURING LINCENSEES for Continental Europe: George Fischer, Ltd., Schaffhausen, Switzerland; for British Empire, excluding Canada: Tilghman's Patent Sand Blast Co., Ltd. Broadheath, Nr. Manchester, England. SALES REPRESENTATIVES: Brazil— Equipamentos Industriais "Eisa" Ltda.; Argentine— Clarfix S. R. L.; Mexico — Casco, S. De. R. L.; Puerto Rico — Angel Cabiella.

American

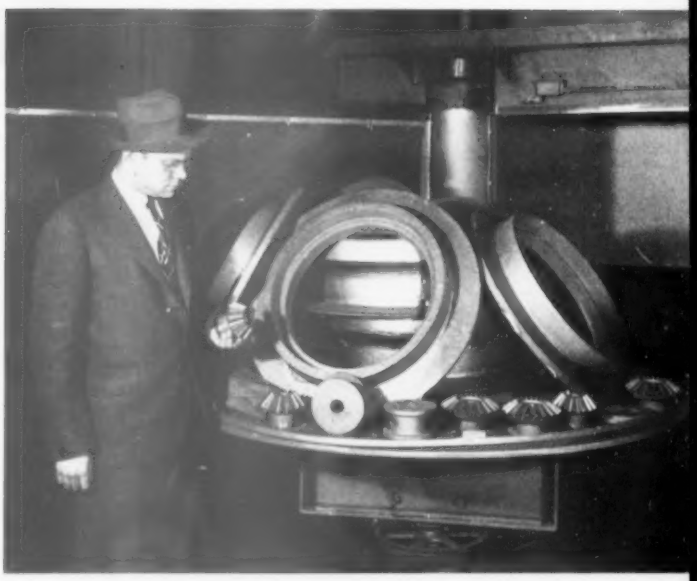
WORLD'S LARGEST BUILDERS

CASE HISTORY No. 17

Wheelabrator® SWING TABLE

SAVES $5,500 per year

for CAROLINE FOUNDRY CO.
Baltimore, Maryland



Your money brings a greater return when you invest in a WHEELABRATOR

Every dollar you spend on a Wheelabrator comes back many times and many ways. For instance, at the Caroline Foundry Company, a 66" Wheelabrator Swing Table earned $5,500 in direct, traceable savings its first year of operation. It saved 23 man hours daily and reduced cleaning costs $2.20 per ton.

Use of the Swing Table so improved cleaning that inspection was simplified and defects were immediately revealed. Caroline Foundry profited from the cleaner surface through increased customer satisfaction and the elimination of customer complaints.

Because the Swing Table thoroughly removes all sand, chipping and grinding time have been reduced. Cost of these operations has been cut from $1.76 to $1.10 per ton. In addition machining operations take less time and tool life has been increased.

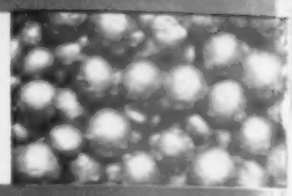
There is a Wheelabrator Machine of the size and type to fit your needs. Write today stating your needs. We can show you in our testing laboratory how a Wheelabrator will give you a greater return for your investment.

COST COMPARISON CHART

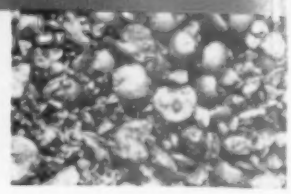
	FORMER METHOD	WHEELABRATOR METHOD
MACHINE and PROCESS	Tumbling mill and wire brushing	66" Wheelabrator Swing Table
PRODUCTION	10 tons daily	10 tons daily
LABOR REQUIREMENTS	36 man hours as follows: Tumbling—1 man—4 man hrs. Wire Brushing — 2 men — 16 man hours. Chipping and Grinding — 16 man hours.	13 man hours as follows: Cleaning — 3 man hours. Chipping and Grinding — 10 man hours.
COST PER TON	$4.19	$1.99
SAVINGS	Per Ton $2.20	Per Day $22.20	Per Year $5,550.00

Prominent Philadelphia Manufacturer

SLASHES abrasive costs 63% with TRU-STEEL*



TRU-STEEL
No. 230 at Mag. 10X
after 1500 Passes



CHILLED IRON
No. 230 at Mag. 10X
after 50 Passes

An accurate test of abrasive consumption in a Wheelabrator Cabinet at an Eastern plant revealed that the abrasive cost per wheel hour with TRU-STEEL shot was only 52½¢ compared to $1.38 for chilled iron abrasive. During the test only 360 lbs. of TRU-STEEL were required — in a comparable period 2,670 lbs. of chilled iron were used. Machine parts lasted approximately 25% longer, materially increasing the total savings effected.

*Tru-Steel Shot is manufactured by Steel Shot Producers, Inc., Butler, Pa.

American
WHEELABRATOR & EQUIPMENT CORP.

COMPARISON CHART

	Chilled Iron	TRU-STEEL
Consumption per wheel hour	30.70 lbs.	4.67 lbs.
Cost per pound	$ 0.045	$0.1124
Cost per wheel hour	$ 1.38	$0.525

SAVINGS (Per Wheel Hour)..... **$0.855**

American

CORE ROD STRAIGHTENER

SAVES 57.9%

of its cost per month

Every month, a prominent manufacturer* SAVES 57.9% on his original investment in two American Core Rod Straighteners. The machines released nine men for more productive work that formerly were required to straighten core rods by hand. This created a direct savings in labor and material of $12,000 annually.

Get the facts on the American Core Rod Straightener! Learn how you, too, can save manpower and salvage extra dollars from your scrap pile! Send today for Bulletin No. 10-B.

*Name on request.

PLEASE TURN PAGE

American WHEELABRATOR & EQUIPMENT CORP.
505 S. BYRKIT ST. MISHAWAKA 2, INDIANA

TUNGSTEN in various forms and grades has many uses, in metallurgy and other industrial arts. Its uses become still more numerous and more diversified as technical requirements become more exacting. The Molybdenum Corporation offers a comprehensive book on "Tungsten Steel" and will welcome inquiries at any time, on any application of Molybdenum, Tungsten or Boron.

AMERICAN Production, American Distribution, American Control, Completely Integrated.

Offices: Pittsburgh, New York, Chicago, Cleveland, Detroit, Los Angeles, San Francisco, Seattle.

Sales Representatives: Edgar L. Fink, Detroit; Brumley-Donaldson Co., Los Angeles, San Francisco, Seattle.

Subsidiaries: Cleveland-Tungsten, Inc., Cleveland, O.; General Tungsten Manufacturing Co., Inc., Union City, N. J.

Works: Washington, Pa.; York, Pa.

Mines: Questa, New Mexico; Urad, Colorado.

MOLYBDENUM CORPORATION OF AMERICA
GRANT BUILDING PITTSBURGH, PA.

MCA

RINGS THE BELL AGAIN!

WITH THIS

NEW VARI-SPEED SNAGGING GRINDER

utilizing built-in vari-speed drive

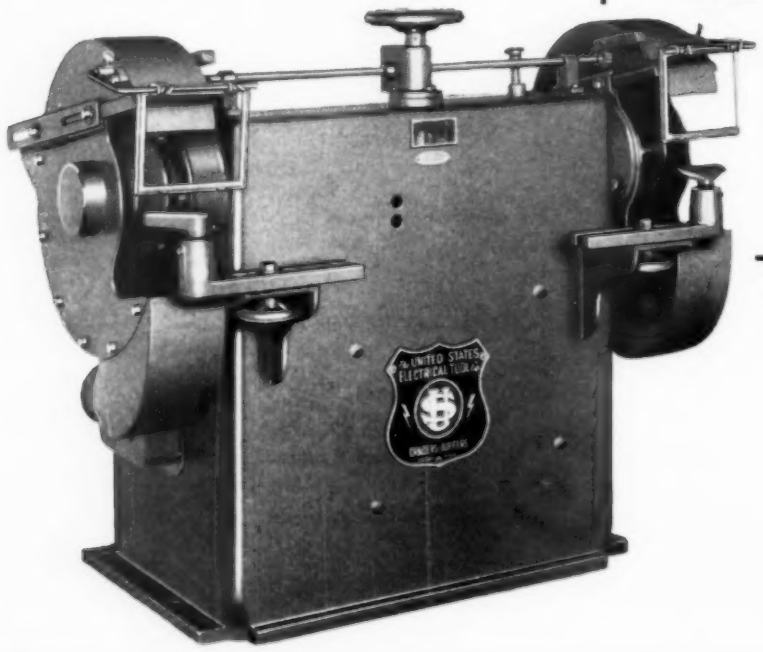
Note these important features:

- INFINITELY VARIABLE SPEEDS
- ADJUSTABLE WHEEL GUARDS GOVERN SPEED OF WHEEL
- PERFECT PERIPHERAL SPEED MAINTAINED THROUGHOUT LIFE OF WHEEL
- IMPOSSIBLE TO OVER-SPEED

Model 64VS

Here's another "FIRST" in a long line of improved and advanced ideas in foundry equipment. In keeping with the United States Electrical Tool Co.'s history for over half-a-century as pace-setters to the industry this new snagging grinder brings to every foundry

POSITIVELY LOWEST COST IN TIME and LABOR



for wheels up to 24 inches
3 to 10 hp
Write TODAY
for new revised
Catalog 59-A

The **UNITED STATES ELECTRICAL TOOL** *Co.*
CINCINNATI, OHIO

*additional evidence of the *plus value* in CHATEAUGAY PIG IRON

Because internal temperatures sometimes rise as high as 1500°F., heat-resistance is a vitally important requirement in heavy-duty brake drums, such as those shown above in rough and finished form. Without exceptional heat-resistance, check and cracks develop on inner surfaces . . . brake life is shortened . . . maintenance costs skyrocket.

That's why America's leading brake drum manufacturers have adopted a fixed policy of using Republic CHATEAUGAY Pig Iron in all brake drum castings. Yet, unusually high heat-resistance is but one of many properties which enable CHATEAUGAY to consistently out-perform all other pig irons—in the foundry . . . in the machine shop . . . in actual service.

Other cost-saving advantages afforded by this low-phosphorus, copper-free iron include: *precise "physicals" held to narrow limits . . . exceptional machinability . . . fast-flowing and even-cooling characteristics . . . wear-resisting surfaces.*

A Republic Pig Iron Metallurgist will be glad to show you how you, too, can profit from the use of CHATEAUGAY. Write *today* to:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

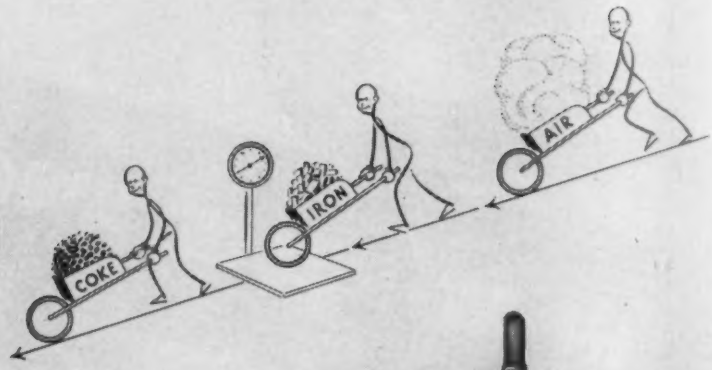
Republic PIG IRON

"CHATEAUGAY"	"REPUBLIC"	"PIONEER"
Low-Phosphorus, Copper-Free	(Northern) Foundry, Basic and Malleable	(Southern) Foundry and Basic

REPUBLIC STEEL

ALSO TRUSCON FOUNDRY FLASKS • REPUBLIC CORE WIRE • FOUNDRY NAILS

Foundry costs come down

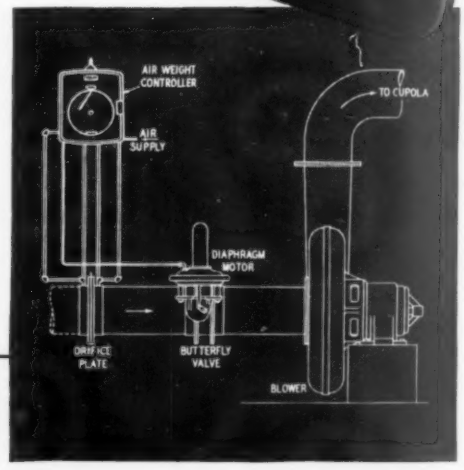


. . . when you weigh air too

Leading foundries report lower fuel costs, fewer rejects, and less pigging after installing Foxboro Air Weight Control. That's because the cupola blast is fully compensated for every change in atmospheric pressure and temperature. *The right amount of oxygen for the quantity of coke charge* insures better combustion, more uniform heats and better quality castings.

Foxboro Air-Weight Controllers automatically control cupola blast by *weight of air* instead of volume. They are one of Foxboro's many original developments in instrumentation to cut industrial costs. Representative installations will be found throughout the foundry industry. The names of those located nearest you will be gladly sent on request.

Now, . . . you can make the most of modern foundry practice by installing the advanced-design Model 40 Air-Weight Controller by Foxboro. Installation is easy and fast. Results will far outweigh the investment. Write for complete details. **The Foxboro Company, 32 Neponset Avenue, Foxboro, Mass., U. S. A.** Branches in principal cities.



Typical installation set-up of Foxboro Air-Weight Control . . . readily adaptable to either a centrifugal blower (shown in diagram) or a positive displacement blower.

FOXBORO REG. U. S. PAT. OFF. **AIR-WEIGHT CONTROLLERS**

RECOGNIZE THESE COST-CUTTING NORTON WHEEL SYMBOLS?

B-5

B-7

These symbols designate wheels that really do cut faster and smoother *without* sacrifice of wheel life!

B-5 Resinoid Bond is popular for wheels in the soft and medium-hard range, while B-7 Resinoid Bond, a stronger and more heat-resistant bond, is designed for wheels in the harder grades.

Both of these outstanding resinoid bonds are available with Norton ALUNDUM and CRYSTOLON abrasives. And you'll find a Norton wheel of exactly the right combination to produce the results you're after quickly and economically.

If you're not already taking advantage of these Norton wheels, why not contact your Norton abrasive engineer or distributor soon and arrange for tests—no obligation of course.

NORTON COMPANY • WORCESTER 6, MASS.

Distributors in All Principal Cities—Consult Your Classified Telephone Directory

W-1286

NORTON
ABRASIVES

Making better products to make other products better

COLEMAN OVENS BAKE CORES AT LOWER COST than any other known method

COLEMAN OVENS, because of their exclusive features, produce at the lowest cost, since they—

...***use*** the handling method that gives you the greatest savings in labor!

...***obtain*** the greatest savings from the most economical fuel available!

...***permit*** you to use the most satisfactory binder for your work!

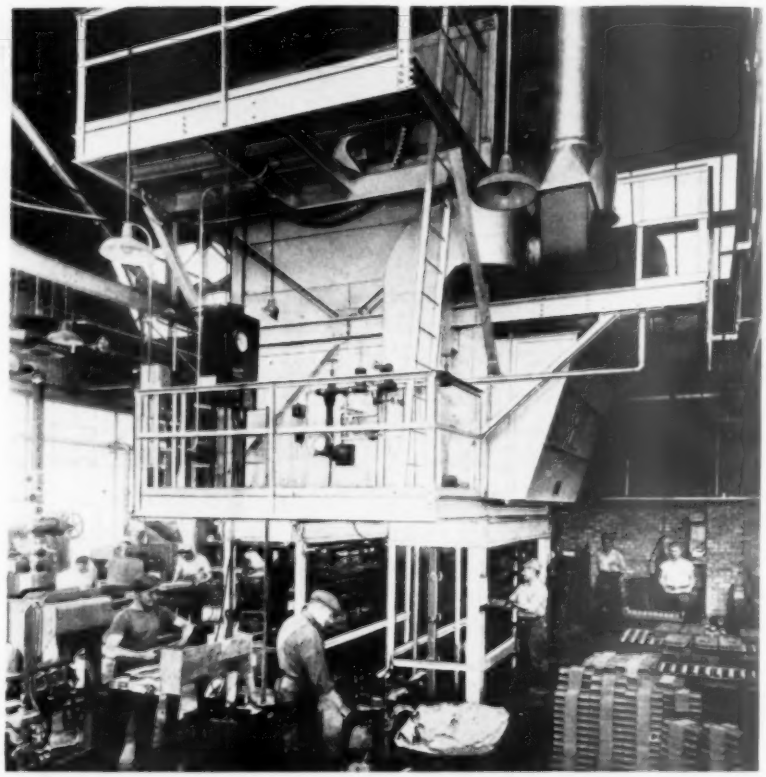
...***utilize*** your available space to the greatest advantage!

...***assure*** perfect baking and drying, eliminate rejects and makeovers.

...***keep*** maintenance cost and time down to a minimum.

COLEMAN OVENS back up these statements with experience gained from over 10,000 installations. No other method of baking cores can match these results...no other core-baking system can meet this record!

For full information about Coleman Ovens write for Bulletin 48 today!



COLEMAN TOWER* OVEN
at Wells Manufacturing Company, Skokie, Illinois

High speed core production at lowest cost. Patented Open Center provides greater loading accessibility and increases core-maker productivity.

COLEMAN OVENS **are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.**

*Trademark

WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

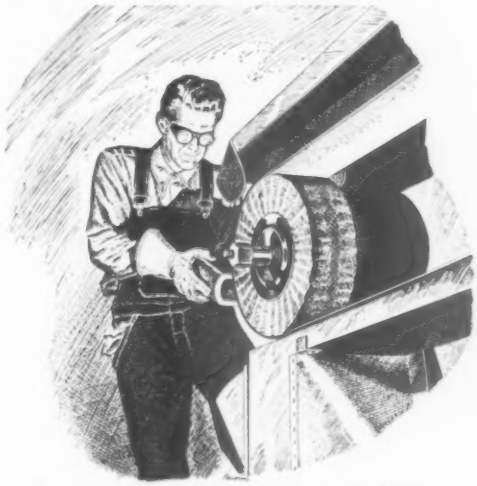
THE FOUNDRY EQUIPMENT COMPANY

MEMBER FEMA

1831 COLUMBUS ROAD CLEVELAND 13, OHIO

OVER 10,000 SUCCESSFUL INSTALLATIONS

COATED PRODUCTS COMMENTS



How to get more from your backstand grinders

Increasing the productivity, economy and efficiency of backstand grinders is a common goal toward which we have worked with a number of foundrymen. This valuable experience has turned up a considerable number of ideas and practices that have led to practical operational improvements.

There's the foundry where a slightly different backstand grinder application was developed which boosted grinding production by two-thirds. In an aluminum foundry, a suggested belt change cut production time in half. And, in still another typical case, belts are lasting one-third longer because of a simple recommendation.

This is the kind of experience which we feel can be of practical value to you in stepping up backstand grinder production, cutting costs and solving your other grinding problems. We will be glad to share it with you. Prompt attention will be given your inquiries. Coated Products Division, The Carborundum Company, Niagara Falls, New York.

COATED ABRASIVES BY

CARBORUNDUM

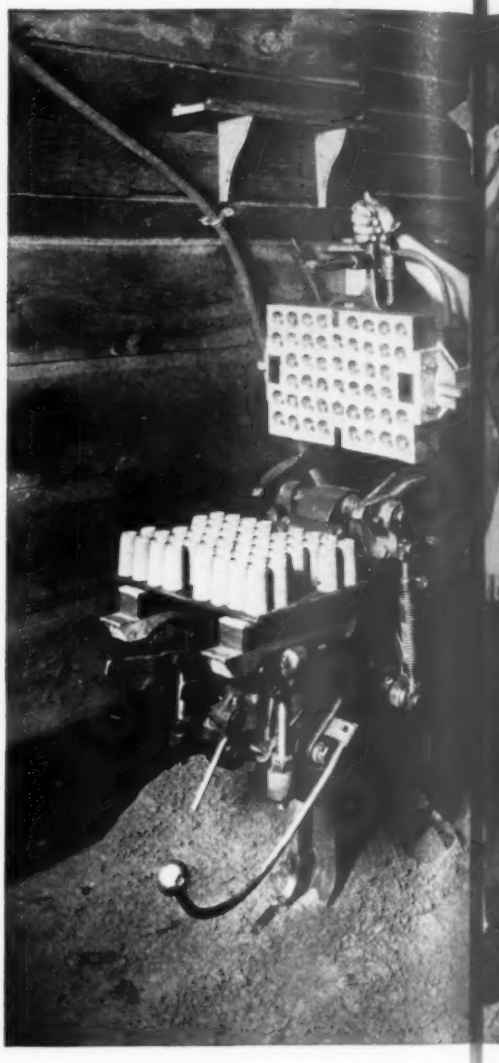
TRADE MARK

Making ALL abrasive products . . .
to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

INTERNATIONAL TYPE R

Jolt Ram · H
Hand or Foo



TYPE RJ— Jolt Ram, Hand Turnover, Hand or Foot lever Draw Machine, is built in a wide range of sizes from 14" x 8" draw up to 20" x 12" draw.

The overall construction and design of the International RJ makes for convenient operation.

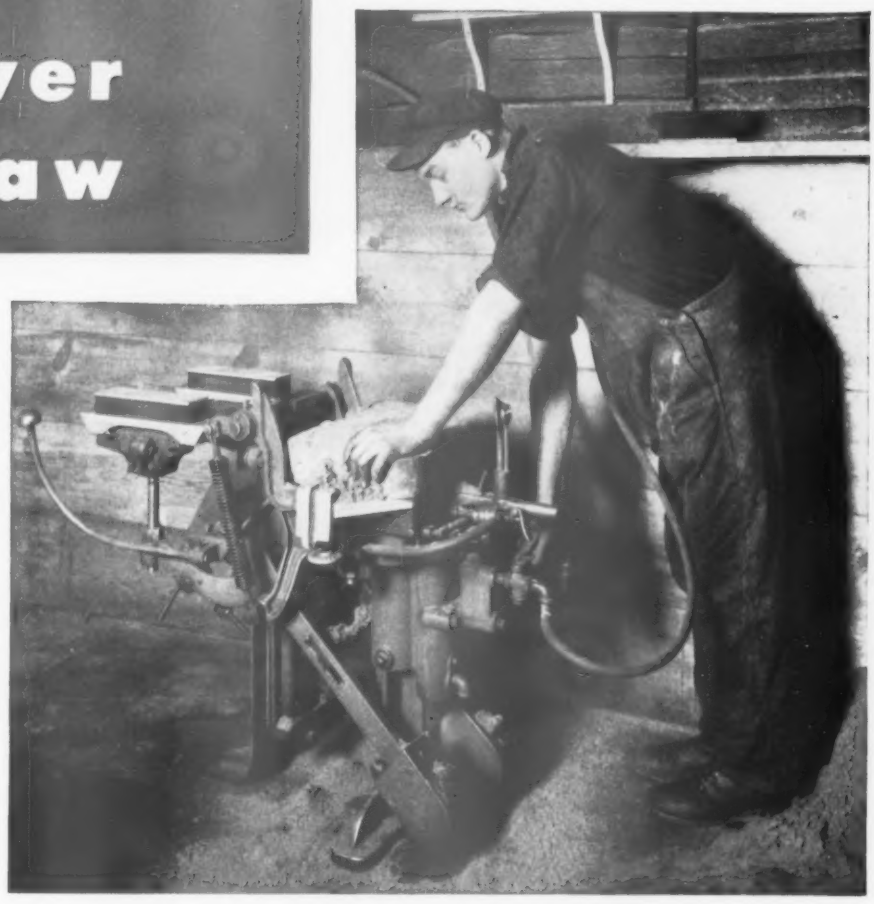
THE RJ MACHINE IS JUST ONE OF THE 90 STANDARD TYP

INTERNATIONAL MOLD

LA GRANGE P

RJ MOLDING MACHINE

Hand Turnover
Lever Draw



- Inquiries should specify outside width and length of the largest flask or core box to be handled and amount of draw required.
- The International **TYPE RJ** is designed, as are all of the machines in the line, by experienced foundry engineers who have a practical working knowledge of the problems of the business.
- The RJ is used extensively for cores.

TYPE AND 1400 DIFFERENT SIZES IN THE INTERNATIONAL LINE

DING MACHINE COMPANY

PARK, ILLINOIS

Foundries Find MANHATTAN WHEELS Materially Lower Cutting Costs

For High Speed Grinding

Manhattan Abrasive Wheel Engineers have mastered the problems of fast cutting and long wheel life. They "Custom Manufacture" wheels for the particular metal alloy you are working. This becomes YOUR wheel formula and all subsequent orders are manufactured under laboratory controls to insure wheel efficiency consistent with the performance originally engineered for you. That is why many foundrymen claim Manhattan Snagging Wheels maintain the highest output per-man-hour on their swing frames, stands, and portable grinders.

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Manhattan Cut-Off Wheels are noted for their cool, quick cuts and long life on all types of metals. They remove gates and risers without burning or checking the metal. Because cuts can be made close to the casting, snagging is greatly reduced. Manhattan wheels are consistently showing high savings in foundries which keep records of speed of cut and number of cuts per wheel. Here again, it is the "Custom Manufacturing" of Manhattan Engineers that pays off on YOUR particular alloy.

Don't hesitate to call a Manhattan Abrasive Wheel Engineer. He is qualified to help you with problems of cutting, grinding and finishing.

ABRASIVE WHEEL DEPARTMENT

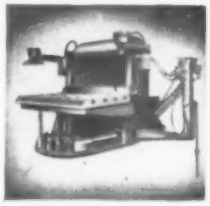
MANHATTAN RUBBER DIVISION

PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC., Manufacturers of Brake Linings • Brake Blocks • Clutch Facings • Radiator Hose • Fan Belts • Mechanical Rubber Products • Rubber Covered Equipment • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

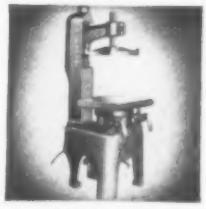
DID YOU SAY YOU WANTED TO *lower* YOUR COSTS?

You Can Produce More Castings

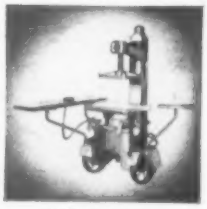


Jolt Rollover Draw, Model A

Jolt Rollover Draw, Model SA

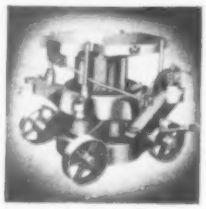


Jolt Squeeze, Model 10-JX (stationary)



Jolt Squeeze, Model 10-JX (portable)

Jolt Pin Lift Model AJS (stationary)



Jolt Pin Lift, Model AJS (portable)

It is easy to reduce your costs with Davenport Foundry molding machines.

FIRST, YOU . . . save man-hours and you save on your payroll. SECOND, YOU . . . deliver a higher quality, uniform casting and your orders come in easier.

Davenport Foundry molding machines will make you money. Let us send you our complete catalog, showing over 60 sizes and styles.

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AJAX-NORTHRUP MELTING HITS COMPOSITION

"Right on the Nose"

And every heat of today's high-performance alloys *must* be checked out "right on the nose." The slightest oxidation or contamination means rejected castings—or loss of time and alloying constituents trying to bring the melt up to par.

That's why more and more foundries, alloy steel plants, and precision casting shops are turning to Ajax-Northrup melting as the only practical, economical way.

Ajax-Northrup high frequency furnaces stir as they melt — electrically. There's no carbon to contaminate the charge. One user holds carbon content within two one-hundredths of one per cent. It's so fast there's no oxidation. Savings in constituents and deoxidizers alone give Ajax-Northrup furnaces a two-to-one cost advantage in a nickel-steel plant. Melts fast or slow, or holds steady temperature. Easy to charge, requires little attention while melting.

33 YEARS OF EXPERIENCE

By combining the right work-proven Ajax-Northrup units with the right controls, we can tailor high frequency melting to your requirements. Motor-generator power from 25 to 1200 kw. and up. Self-tuning, trouble-free spark-gap converters from 3 to 40 kw. Furnaces from one ounce to a ton for all non-ferrous, and precious metals—to 8 tons for ferrous metals. Just name your alloys and quantities—we'll send you the proper technical bulletins—free.

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AJAX PARK, TRENTON 5, N. J.

SINCE 1916

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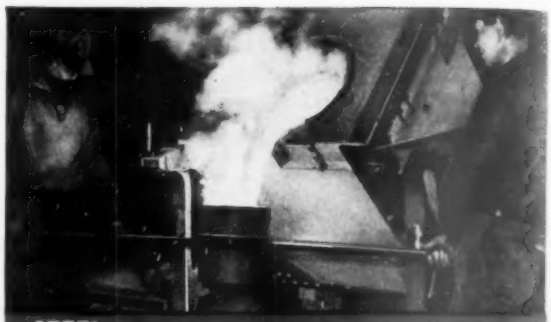

STEEL

BRASS AND BRONZE

ALLOY CAST IRON

PRECISION CASTING

117

Associate Companies

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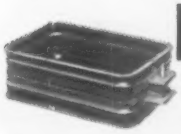
AJAX ELECTRIC COMPANY, INC. • AJAX ENGINEERING CORPORATION

Truscon has the

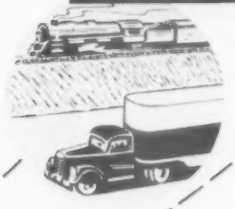
technical service

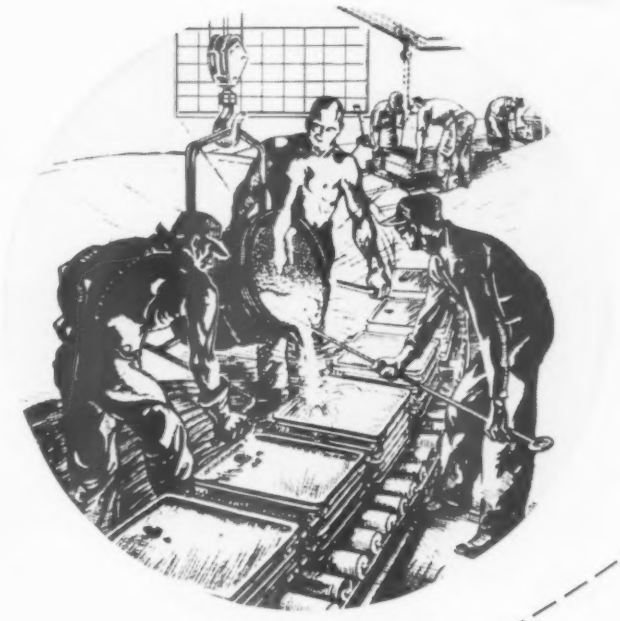
design



steel materials

deliveries



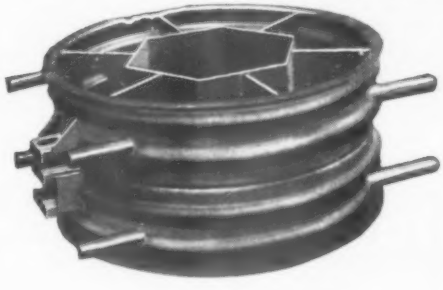


you need in

foundry flasks

Above:
Model TM-10
two man flask

Below:
Model TM-60
two man round flask

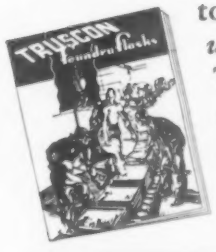


. . . and they all add up to *better production* for you!

Better production because Truscon Steel Flasks are efficient . . . are made to fit specific, individual foundry jobs.

Better production because Truscon Steel Flasks assure *continuous* production! They're made strong where strength is needed... made of rugged heavy gauge steel that wears as only steel can wear... month after month, year in, year out!

Truscon's prompt delivery service helps foundry production, too, because Truscon gets the flasks you need *where* you want them *when* you want them. Truscon men will be glad to work with you and for you to help select the right flasks for *your* particular jobs.



Send for Truscon's catalog complete with specifications and details on Truscon Steel Foundry Flasks.

TRUSCON STEEL COMPANY
PRESSED STEEL DIVISION
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Industrial!

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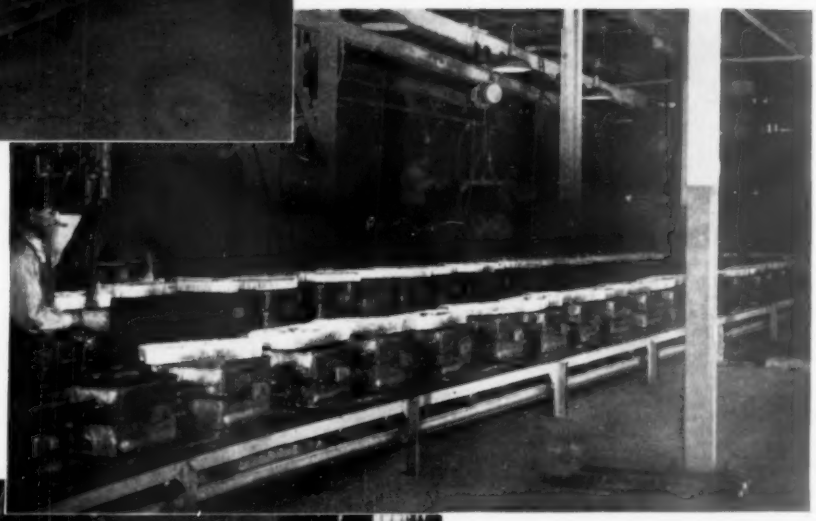
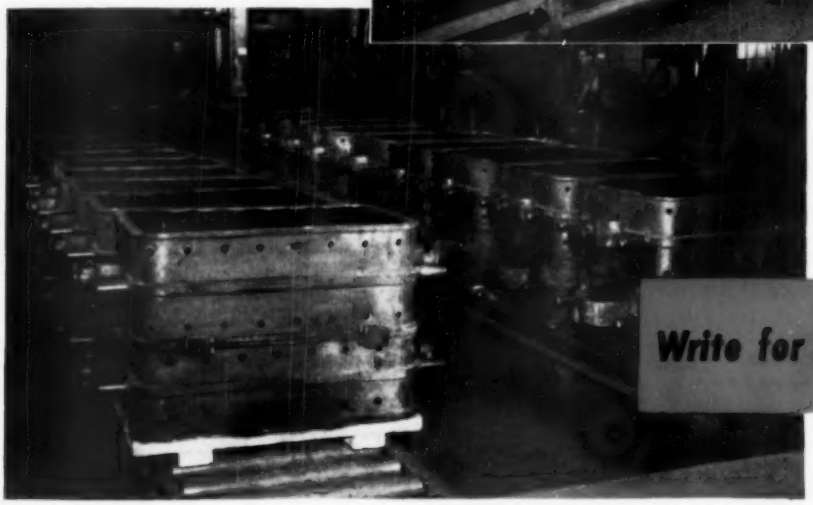


THESE photos show "Industrial" flasks in actual operation at prominent foundries in the United States and Canada. Names on request.



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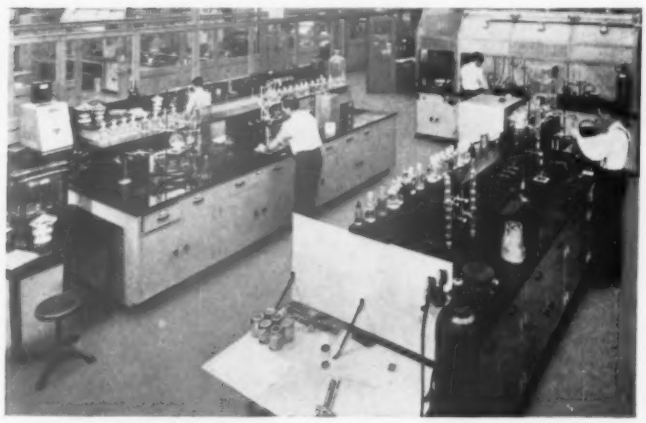
AN AXE TO GRIND?

"U. S." Engineers can develop grinding wheels that exactly fit your particular problem

FROM SLABS TO SAUCEPANS . . . from castings to ball races—whatever your grinding wheel problem—a U. S. Royalite Wheel can handle it. Our technicians precisely engineer each wheel to your specifications . . . submit it to gruelling tests to insure superior performance.

RIGHT FOR THE JOB. 87 years of "U. S." experience and research in bonds and abrasives—and in many other related fields—stand behind every grinding wheel developed. This is your assurance of the right wheel to do the best job.



THIS IS YOUR LABORATORY. Here "U. S." abrasive engineers work to lower your grinding wheel costs. Here they have developed more than 5,000,000 possible combinations of size and construction . . . that have proved more economical and efficient in service.

There's no problem too difficult for our abrasive engineers. Let them give you accurate grinding wheel costs *in advance* and diagnose and solve your problems right in your plant. For complete information, write

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SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

GRINDING WHEEL DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

WE STILL LIKE TO DO BUSINESS THE OLD FASHIONED WAY

(We manufacture modern ferro-alloys for precise alloying of fine steels)

Helpful Service

"Service with sales" is an age-old, time-tested slogan, and it continues to be the key to success and sound business relationships to this day. Our company was built on this premise, and our records show a steady increase in the number of satisfied users of our products.

Prompt Delivery

"Delivery-on-time" goes hand in hand with service. It is our sincere aim to meet scheduled deliveries on the date specified, to help you maintain production schedules.

Ferro-silicon 25, 50, 65, 75, 85, 90% • Special blocking 50% Ferro-silicon • Low Carbon Ferro-chrome Silicon • High Carbon Ferro-chrome • Ferro-manganese • Borosil • Simanal

BRIQUETS { SILICON, MANGANESE, CHROME, SILICO-MANGANESE

Bulletin on SUPER REFRACTORIES

by CARBORUNDUM
TRADE MARK

NO. 8 JULY, 1950

Are Super Refractories Limited to High Temperature Applications?

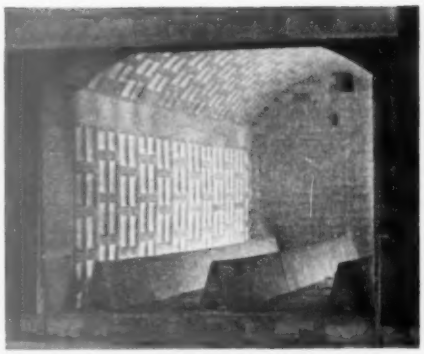
High temperature resistance is an inherent characteristic of super refractories by CARBORUNDUM. However, there are other properties which may be equally important reasons for selecting such refractories — for low as well as high temperature work.

The heat flow rate of CARBOFRAX silicon carbide refractories, for example, is practically the same (for the same temperature difference) at low temperatures as it is at high. Likewise, such properties as chemical stability, hot strength, wear resistance, and heat shock resistance are equally effective in low temperature jobs. Consequently, refractoriness as such, often becomes a secondary reason for picking a super refractory, even where elevated temperatures are involved.

Lowered fuel costs, more production, and appreciably reduced maintenance expenses are all demonstrated benefits of these super refractories that have been realized for reasons aside from high temperature resistance. And although other refractories may be considered adequate from a life standpoint in many low temperature jobs, there is every probability that substantial savings can be effected by proper use of *super refractories* by CARBORUNDUM.

Physical Properties of Super Refractories by CARBORUNDUM
Trade Mark

	CARBOFRAX Silicon Carbide	MULLFRAX Electric Furnace Mullite	MULLFRAX S Converted Kyanite	ALFRAX K Electrically Fused Alumina	ALFRAX B Electrically Fused Alumina	ALFRAX BI Electrically Fused Alumina
Heat Conductivity at 2200° F. in BTU/hr. sq. ft. and °F./in. of thickness	109 BTU	16 BTU	9 BTU	24 BTU	12 BTU	7 BTU
REFRACTORINESS PCE CONE	37-40	38-39	37-38	37-39	39-40	38-39
SPALLING RESISTANCE	High	High	High	Good	Good	Good
ABRASION RESISTANCE	High	Medium	Medium	High	Medium	Low
THERMAL EXPANSION (25° — 1400° C.)	.0000044	.0000059	.0000069	.0000074	.0000086	.0000086
MODULUS OF RUPTURE @ 2460° F. PSI	800-3125	100-250	175-475	100-1050	100-225	50-100
WEIGHT 9 IN. STRAIGHT	9.25 lbs.	9 lbs.	8 lbs.	10.1 lbs.	7.25 lbs.	4.8 lbs.



Muffle Performance Tells the Story

This photograph shows an ALFRAX electrically fused aluminum oxide muffle after six years in a porcelain enameling furnace. For four years, the furnace operated continuously on sheet steel and cast iron stove part production. Then, it was turned to stress-relieving work on heavy armor parts at a temperature of 1295° F. Loads of armor averaged 450 lbs. — were left in the furnace four hours. There were three loads a day, and during each change the temperature was dropped to 800° F. and then returned to its operating temperature.

After six years of this rigorous but relatively low temperature service, the only thing needed in this furnace was a new bottom! The low thermal expansion, chemical inertness and high cracking resistance of the ALFRAX tile kept the side walls and arch in first class condition — and without maintenance. Furthermore, high strength permitted use of thinner tile — aiding heat transfer through the muffle — and assisting fuel economy. Similar advantages are possible in other installations, involving either high or low temperatures.

Uniform Heat Flow Required Here

Used over a varnish fire, this dome provides a soft, even radiant heat. This results from the high thermal conductivity of the CARBOFRAX silicon carbide material. Its use facilitates the "cooking" operation — extends kettle life. Resisting repeated heating and cooling, the CARBOFRAX dome gives longer service and reduces repair bills.

"Carborundum," "Carbofrax," "Mullfrax," "Silfrax," "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company

Address all correspondence to: Dept. A-70, THE CARBORUNDUM COMPANY, Refractories Division, Perth Amboy, New Jersey

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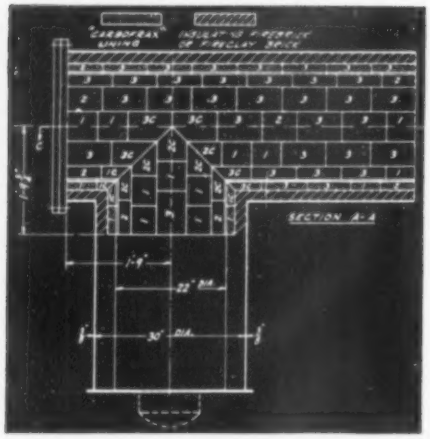


Hot Spots Eliminated in Flue Connector Linings

In the flue connecting a water-gas generator with its carburetor temperatures are relatively low. However, fireclay linings often erode in limited areas because of scurfing by the coke particles. Hot spots develop and production must be interrupted for repairs.

Since they are exceptionally resistant to erosion at both high and low temperatures, CARBOFRAX silicon carbide tile are ideally suited for this application. They retain their original thickness much longer, even at tees, ells and sweeps, where punishment is most severe. Also, the hard, dense CARBOFRAX tile resist carbon penetration and build-up. Elimination of expensive shutdowns, and of repeated repairs, quickly pays back the initial investment.

This is another example of where other specialized properties of CARBOFRAX brick and tile are more important than refractoriness.

Abrasion, the Main Problem Here

Abrasion used to be the principal problem of this furnace. Operated at temperatures under 2000° F., the floor was worn away when aluminum-bronze castings weighing up to 700 lbs were dragged across it. The resultant unevenness of the hearth caused the castings to sag during heat treatment.

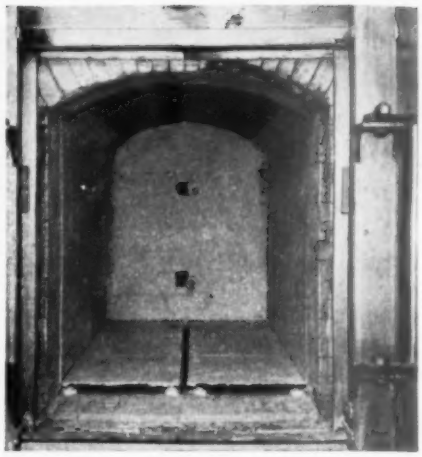
The problem has now been eliminated by using CARBOFRAX silicon carbide tile with their high abrasion resistance. The floor remains level, and distortion of castings avoided. Furthermore the hearth is still in operation after more than three years — a life figure that compares with about one a year for other types of hearths.

The high thermal conductivity of CARBOFRAX tile — another property equally useful at low temperatures — has also resulted in other improvements. First, more uniform and rapid heat delivery to the work chamber gives an improved heat treatment. Secondly, fuel consumption has been reduced. And, finally, the furnace can now be operated faster due to a quicker temperature come-back after being charged.

Super Refractory Picked for High Thermal Conductivity

This sulphur burner combustion chamber — shown in cross-section — is an interesting application of a CARBORUNDUM super refractory for a relatively low temperature job. The high thermal conductivity of CARBOFRAX silicon carbide brick is used to excellent advantage in the arch. Principally because of this feature it is possible to operate the unit at exceptional ratings and still maintain required temperatures of gases entering the Glover tower.

When a standard 9" thick fireclay arch is used in a burner of this type, approximately 1000 BTU's per hr. and sq. ft. are dissipated. A CARBOFRAX arch, however, dissipates approximately 4000 BTU's per hr. and sq. ft. This is due to the high thermal conductivity of the CARBOFRAX brick, and also because of the fact that their great mechanical strength makes possible an arch only 4½" thick. As a result, an extra ton of sulphur is burned each 24 hrs. per 24 sq. ft. of CARBOFRAX arch. Moreover, because of their low thermal expansion, inertness to furnace gases and absence of spalling and cracking, CARBOFRAX arches like this one are still in use after 18 years of continuous service.



Here Again, Refractoriness of Secondary Importance

In this gas-fired artware kiln, the high thermal conductivity of the CARBOFRAX silicon carbide muffle comes into play. It permits more rapid and uniform heat delivery to the ceramic ware — with a consequent improvement in ware quality and a decrease in the number of rejected pieces. Moreover, it is unnecessary to maintain as high a temperature in the combustion chamber to secure the requisite heat in the working chamber — which means longer life for the other refractories — and lower fuel costs.

Other characteristics of CARBOFRAX tile important here are: High strength, which permits using thinner tile to further aid heat transfer; and high resistance to spalling and cracking which means long life in spite of repeated heating and cooling.

To obtain facts and figures on installations in specific fields merely select from this list of bulletins. Copies will be sent you at once. No obligation, of course.

Super Refractories by CARBORUNDUM (general catalog)

Super Refractories for the Ceramic Industry

Super Refractories for the Process Industry

Super Refractories for Boiler Furnaces

Super Refractories for Heat Treatment Furnaces

Super Refractories for Gas Generators

The Frax Line of Cements

CARBOFRAX Refractory Skid Rails

Porous Media for Filtration & Diffusion

Dept. No. A-70

THE CARBORUNDUM COMPANY

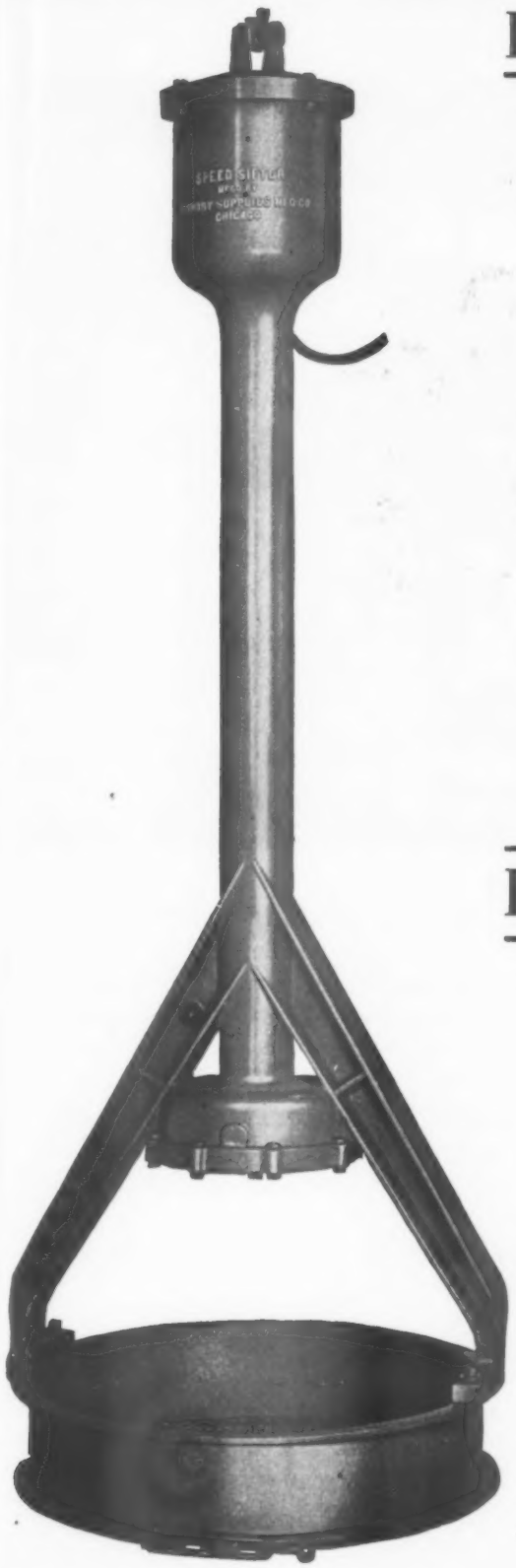
Refractories Division

PERTH AMBOY, NEW JERSEY

Increase Production

with the

ROTOPLANE SPEED SIFTER ★ RED ELECTRIC VIBRATORS



ROTOPLANE SPEED SIFTER

The ROTOPLANE Speed Sifter is an *improved* sand riddle of much greater capacity and much longer life. One size and type serves all purposes in the foundry—does *all* your sifting more quickly and economically.

It is easily handled by one man, weighs approx. 90 lbs., is 62 in. high overall. The one-piece frame of tough aluminum alloy makes for a remarkably effective vibration. Its smooth, free, rotary action vastly increases bearing life; all bearings grease packed. All mechanism of the ROTOPLANE is *completely* enclosed—no bearings or activating parts of any kind exposed to dust and grit.

The Quick-Change Sieves are instantly interchangeable, mounted in smooth, flat steel ferrule, with 20-inch diameter clear sifting area. No jagged edges to tear workers' hands, no storage problem.

$245.00 f.o.b. Chicago—complete with cable, safety ground wire. Standard 1/3 h. p. motor, 110 volt, 60 cycle, single phase and 220 volt, 1 or 3 phase.

UNIVERSAL FREE - WHEELING RIDDLE equipped with motor as above $225.00

RED ELECTRIC VIBRATORS

True-to-pattern castings make satisfied customers . . . more repeat business. Increase your production and castings quality with RED Electric Vibrators. Sturdy, dustproof, lowest operating cost (electricity does not freeze). Unequaled for consistent year-'round results in foundries all over the world.

(All Prices f.o.b. Chicago)

No. 1—Light match plate work	$11.00
No. 2—Medium match plate work	13.00
No. 5—Heavy match plate, tub and bench work	17.00
No. 9—Machine and heavier work	26.80

Third (ground) wire per U. S. Govt. code—furnished with No. 9 at no extra cost; $1.20 extra with Nos. 1, 2 and 5 vibrators.

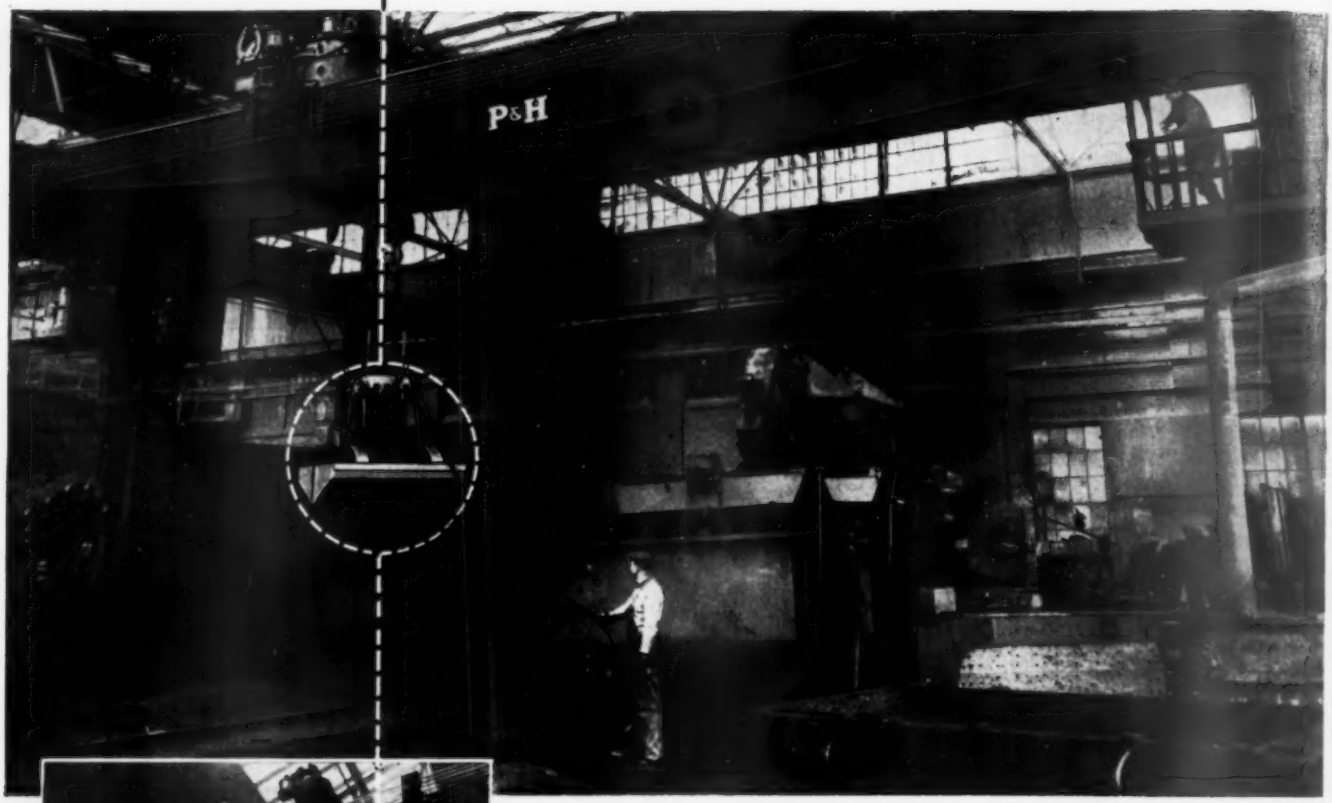
KNEE SWITCHES for operating Red Electric Vibrators:
Single pole $5.00, Double pole $6.50.

FOUNDRY SUPPLIES MANUFACTURING CO.

2221 Orchard Street **Chicago, Illinois**

CABLE ADDRESS: "ROTOPLANE CHICAGO"

P&H SINGLE LINE GRAB BUCKETS



a *"Natural"* in foundry service!

In a matter of seconds you can attach the P&H Single Line Grab Bucket to your crane hook and it's ready to go to work. It's as simple as that — and it provides easy, accurate one-man operation. It works fast, bites deep, picks up clean.

Here's the fast, easy way to handle all kinds of bulk materials — sand, coke, crushed stone, cinders, etc. It's widely used to unload cars, dig pits, fill flasks, etc. A "natural" for foundry use if there ever was one.

Available in capacities from ½ to 2½ yds. Write for all the facts about it. Ask for Bulletin C-27.

P&H

GRAB BUCKETS
4405 West National Avenue
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HARNISCHFEGER CORPORATION
ELECTRIC CRANES · EXCAVATORS · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

MELTING AND HOLDING FURNACES

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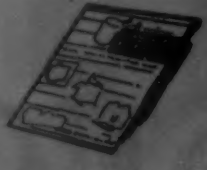

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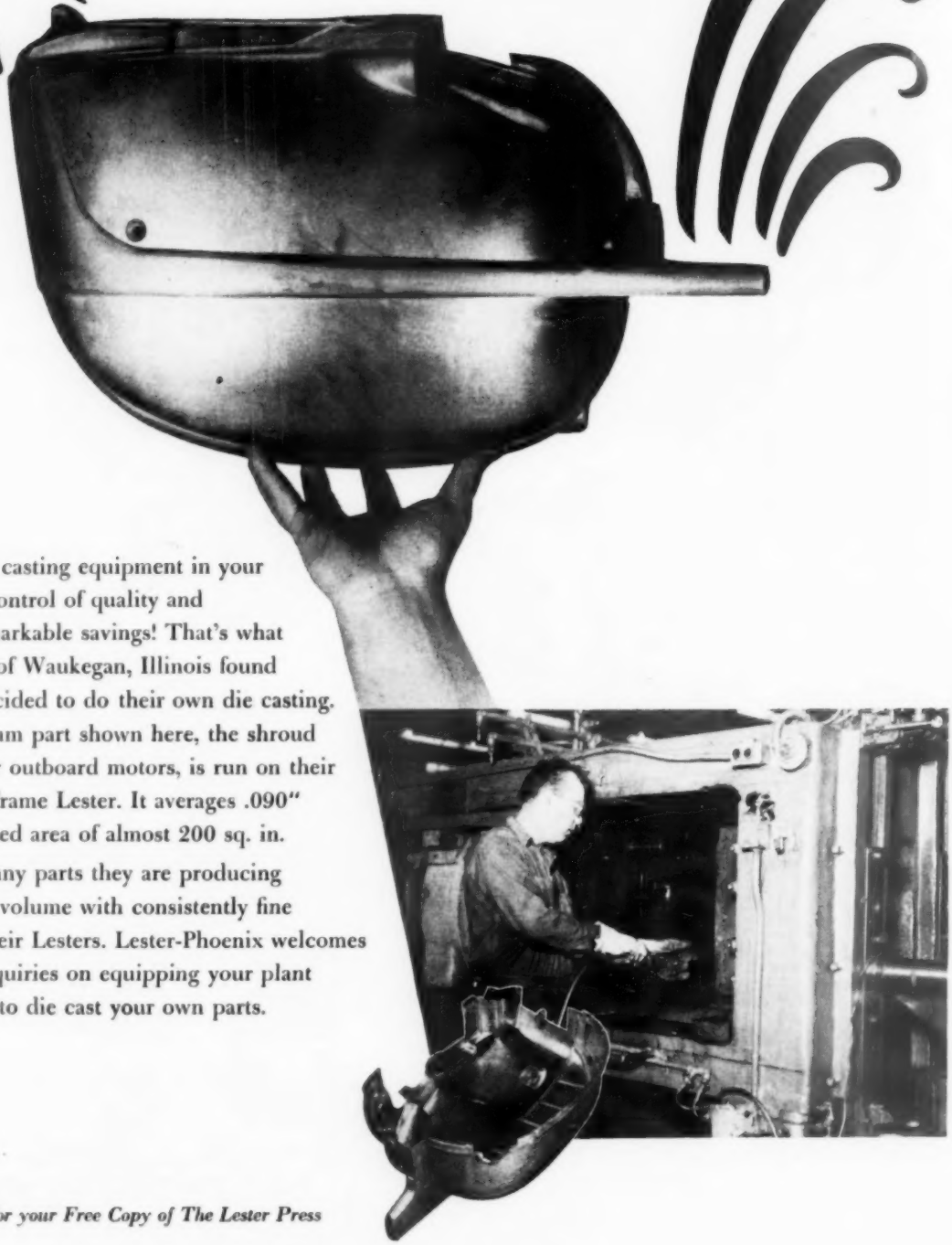

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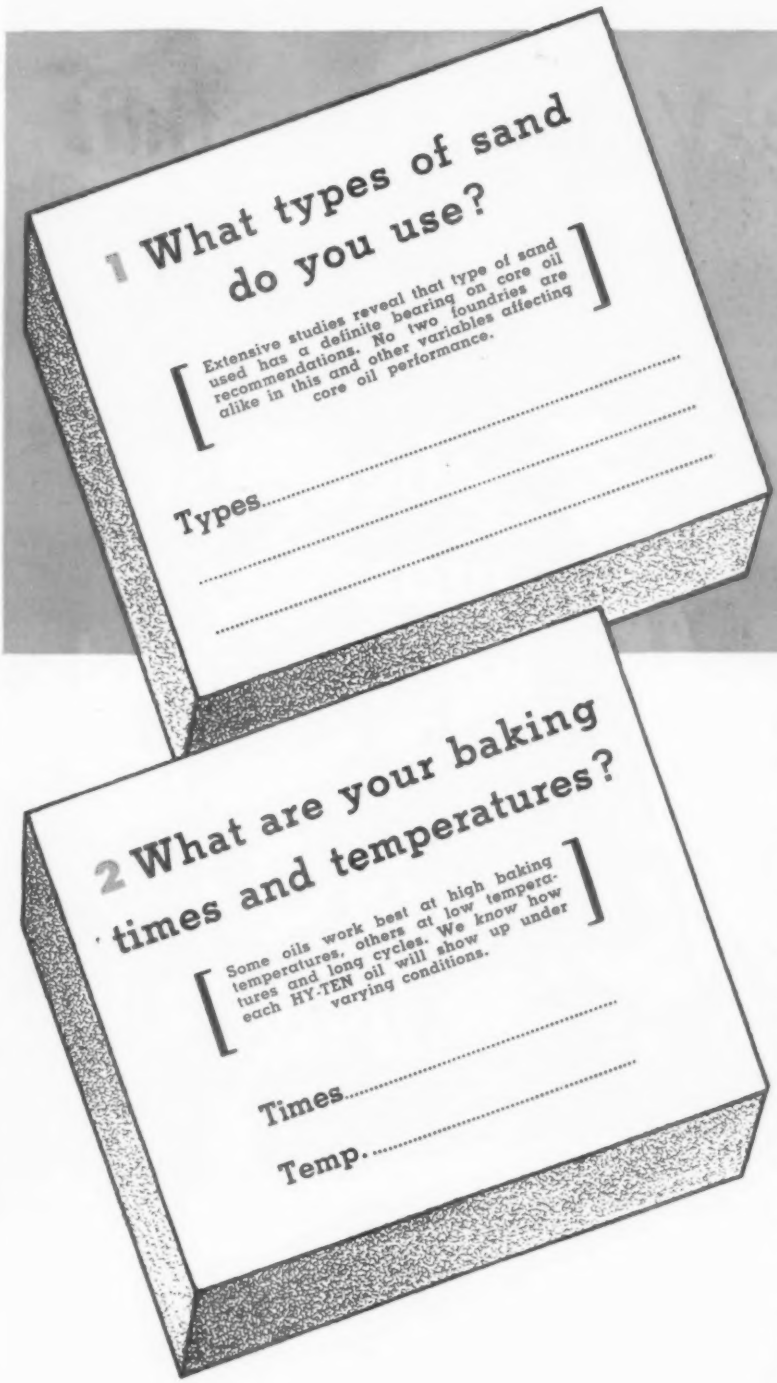
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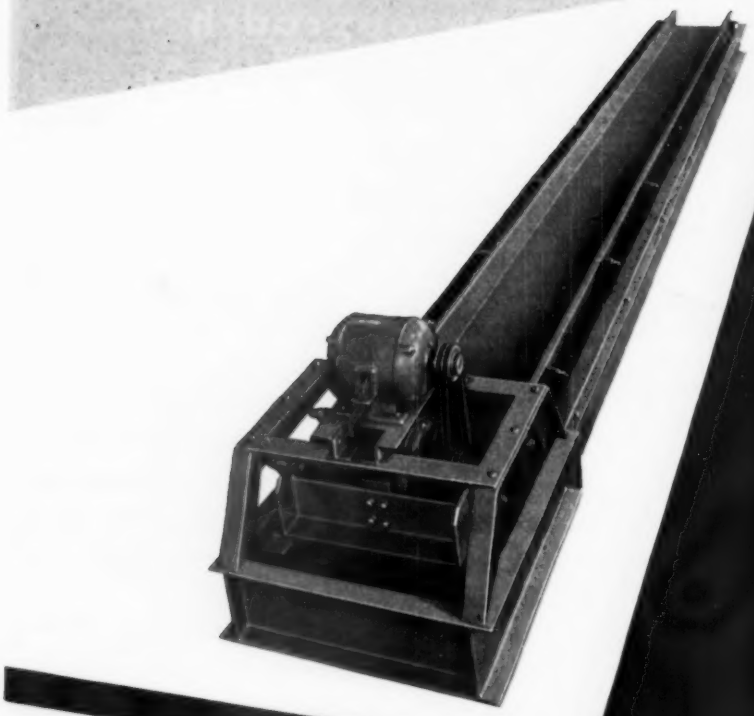

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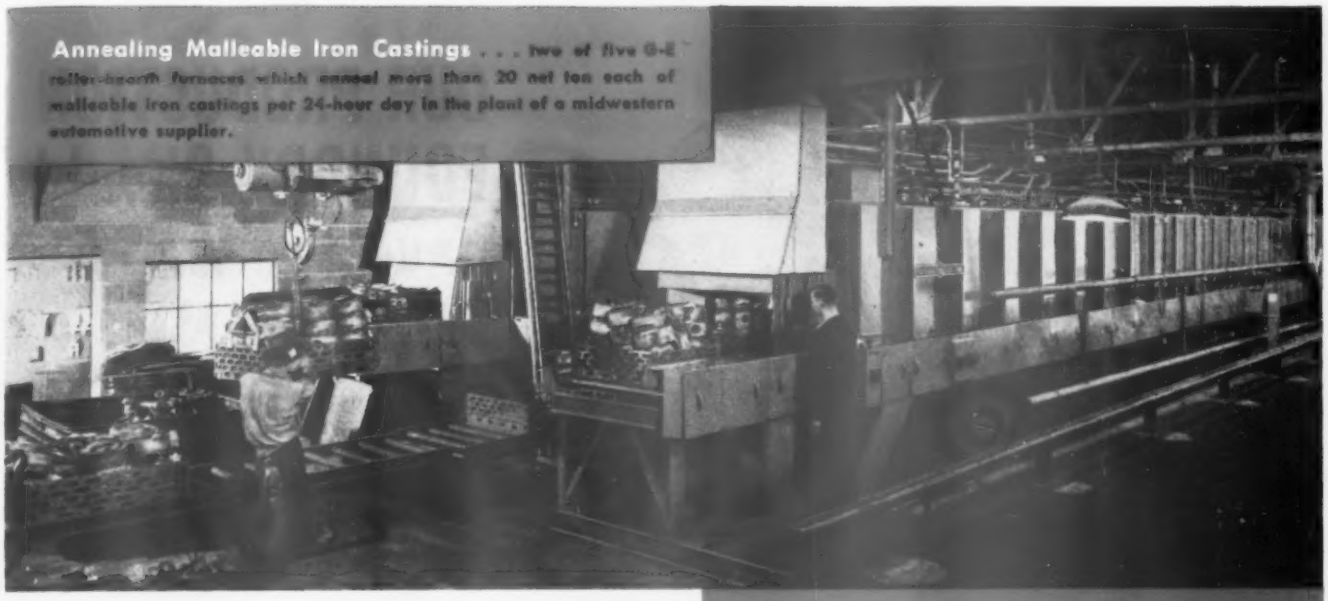

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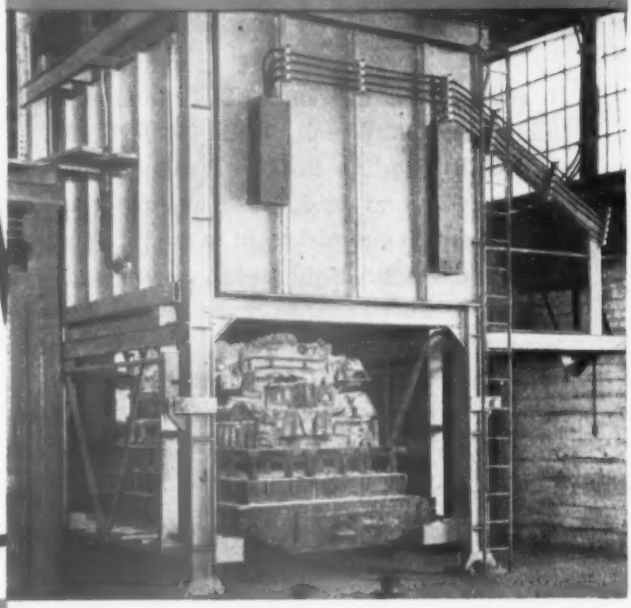

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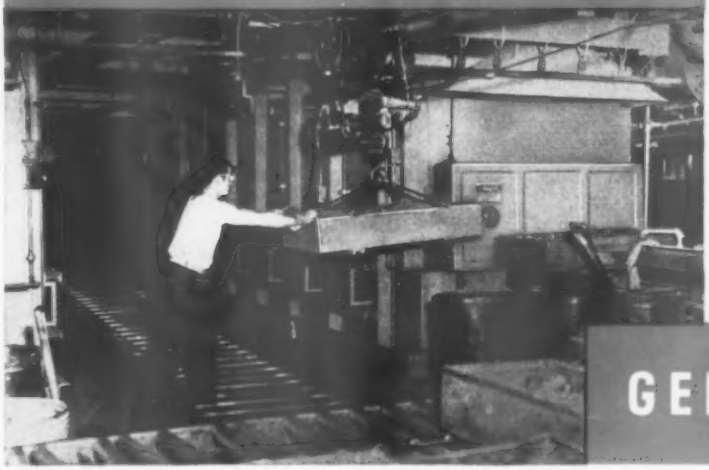

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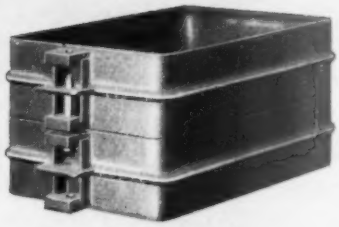

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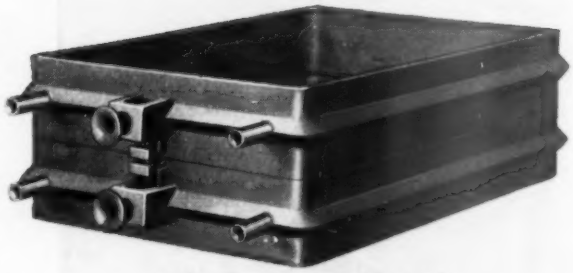

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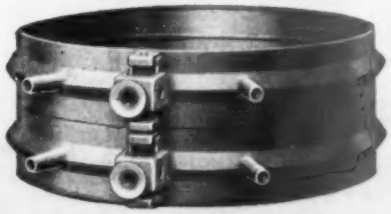

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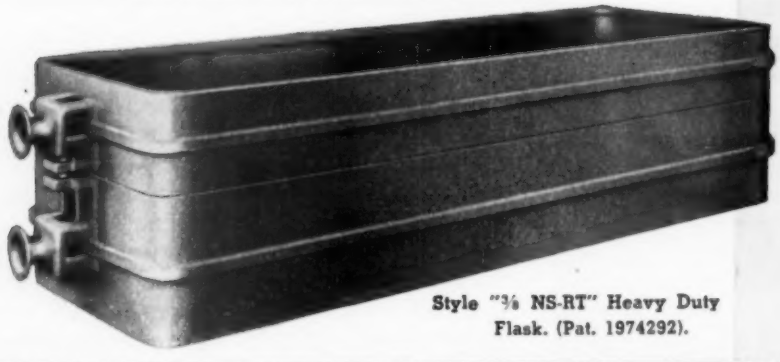

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Foundries Are Safer But Not Safe Enough

AT LONG last the safety work of various organizations serving the foundry industry, and the work of many individuals who understand both the humanitarian and commercial benefits of avoiding accidents, appear to be bearing fruit. Participants in these efforts should find considerable satisfaction in a recent announcement of the National Safety Council that producers of castings made the second best showing of all industries in reducing the accident frequency rate during the past year. Furthermore, this is the second consecutive year that foundries have registered improvement.

During 1949, foundries reporting to the council showed a 34 per cent reduction in the number of disabling injuries per 1 million man-hours. The improvement in 1948 was 16 per cent. In the matter of severity (number of days lost per 1000 man-hours) the industry in 1949 reversed the poorer showing of the previous year and recorded a reduction of 18 per cent.

While this record is gratifying, it might be well to take a good look at the record before celebrating the victory. Regardless of improvement, the fact remains that the accident frequency rate of foundries still is too high. In 1949, this rate was 13.87 compared with a rate of 10.14 for all industries. The severity rate was 1.43 in contrast to a rate of 1.03 for all industries. Perhaps it should be pointed out that most of the reports received by the council come from the larger or more progressive organizations who believe in and practice safety. If statistics could be collected from the entire industry, the total probably would be somewhat less satisfactory.

Nevertheless, the records made during the past year prove that progress can be made in reducing foundry accidents where there is a willingness to devote time and money to the problem. The report of the council certainly should present a real challenge to the top management of every foundry, large or small, where the reduction in accidents does not measure up to the published record.

To spread the improvement over a greater number of plants, top management must sell itself on safety and must carry the enthusiasm of a safety program throughout the entire organization. Safety practices must be demanded from both management and workers alike. Good housekeeping must be practiced. Safety equipment on both men and machines must be provided. But most of all, the pressure for safety must operate every hour of every day of every year. There can be no time for relaxing the pressure.

If you are not working at top speed on this matter of foundry safety, why not pitch in and help improve the record for 1950 and the years to come?

Frank G. Steinebach
Editor

QUALITY CONTROL

of Aluminum Alloy Castings

By RICHARD R. SENZ
Aluminum Co. of America
Cleveland

CONTROL of quality is a subject of keen interest to producers of all kinds of goods today. Demand is still relatively high, but buyers are more discriminating. Purchases are withheld or new sources of supply are sought if a quality compatible with the price is not maintained.

In this discussion of the quality control of aluminum alloy castings, the following factors will be included: Appearance, dimensional accuracy, internal soundness, mechanical properties and chemical composition. Depending upon the use of a casting, its quality is measured by one, all, or a combination of these properties or attributes. Certain characteristics, such as resistance to corrosion, and others which are inherent in a given alloy composition, will not be considered here. These are the characteristics considered during the process of selecting the material for the job and are not generally subject to normal foundry quality control.

The effects of design and of foundry practices on the aforementioned quality characteristics will be considered first. Second, inspection methods for controlling quality will be considered, and finally, the role of statistical analysis in quality control will be discussed.

Effects of Design—It must be remembered that quality cannot be inspected into a product. It must be manufactured into it. For this reason the foundryman has the right to expect that the designer so design his castings that, with reasonable care, the foundry can produce castings of the desired quality. To achieve this the designer should know and consider the limitations of the casting process to be employed and the alloy specified.

Particularly important in the design of aluminum alloy castings, regardless of alloy or casting process, is the provision for generous fillets at the junction of walls, walls and ribs, and walls or ribs and bosses. Avoiding abrupt changes in section thickness is equally important in assuring good quality castings. If the sections to be joined are of equal thickness, the radius of the fillet should be at least equal to the section thickness (Fig. 2). Joining a thin wall or rib to a heavier section should be accomplished by a gradual blending of the thin wall into the heavy section in addition to the fillets (Fig. 3).

Ribs and fillets are important to the designer as stiffeners and reinforcing members. To the foundryman they are valuable in minimizing distortion during cooling and in aiding the flow, distribution and feeding of metal to reduce shrinkage and cracking. If improperly designed, however, they can be the sources of cracks and shrinkage which no amount of foundry control can completely overcome.

When designing a casting for production in a permanent mold, it is also desirable to place all bosses, or other large masses of metal, at or very near the parting faces of the mold. Such design results in a casting which can be more easily fed and one in which it is easier to maintain control over both surface and internal shrinkage.

Another important design feature in permanent mold casting is the inclusion of ample draft on one-piece cores and on the body of the casting. Insufficient draft may result in excessive dragging and hot cracking.

Fig. 1—Pressure testing a crankcase casting

The temptation to design castings with extremely thin sections should also be avoided. Very thin sections usually necessitate a high pouring temperature with a resultant sacrifice of desirable metallurgical structure and a corresponding reduction in mechanical properties. Generally accepted values for minimum section thickness are 3/16-in. for sand castings and ⅛-in. for permanent mold castings. If the need for light weight indicates that thinner sections are required, it is usually better practice to cast a heavier section and obtain section lightness by machining.

Effect of Foundry Practices—Assuming that design details have been carefully considered and the alloy correctly selected, the task of producing quality castings then rests with the foundryman. His first consideration is the condition of the equipment to be used. For sand castings, molding machines, patterns, flasks, etc. must be in good condition. In the permanent mold foundry, the molds and the various mechanical operating devices must be in good shape and functioning properly. Faulty equipment can result in poor

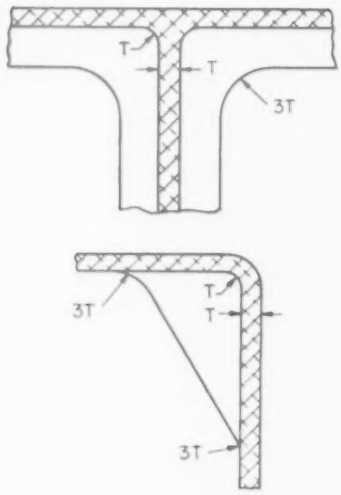


Fig. 2—Method of joining walls of equal thickness

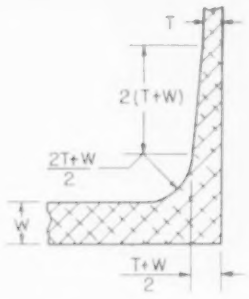


Fig. 3—Method of joining walls of unequal thickness

casting surfaces, mismatches, cracked castings and lowered production rates.

Gating of the casting becomes the next important factor. Gates, sprues, runners and pouring boxes should be designed to reduce to a minimum the turbulence usually accompanying the pouring of molten metal. Excessive turbulence will cause dross inclusions and trapped air pockets which may impair to various degrees, the strength, serviceability and appearance of the castings. Gating systems should be so constructed that they can be kept full of molten metal, thus reducing the turbulence and tendency to aspirate air through the sand or through the parting faces and vent holes in permanent molds.

Pouring height also affects mechanical properties. For this reason sprues and gates should be large enough to permit a rate of flow which will fill the casting from a minimum pouring height. Cope heights on sand molds and heights of permanent molds should be kept as low as possible. Also, the foundry supervisor should see that men pouring castings do not attempt to force a pour by raising their ladles high above the pouring box or sprue opening.

Risers should be large enough to feed the heaviest casting sections and should be placed, whenever possible, so that they do not feed a heavy section through a thin section. In permanent molds, where risers are generally limited to the parting faces of the mold, the establishment of a progressive line of solidification through the use of local chilling, mold contouring and mold wash application can achieve the desired results.

The best practice in developing a gating system for any casting is to start with a minimum of gates and risers and make the necessary increases during the sampling or pilot runs. This usually results in the most economical gating system consistent with the desired quality. Gating development should be carried on in conjunction with two or more of the inspection methods which will be discussed later in this paper, to assure that internal as well as external quality is good.

The metal handling method also can substantially affect product quality. Melting and pouring temperatures must both be kept as low as is possible since each has a profound and independent effect on me-

chanical properties of the castings. Holding times and temperatures must also be controlled carefully, since long holding times at high temperatures may result in variations in chemical composition, excessive gassing of the metal and altered feeding characteristics. Good temperature measuring equipment, preferably of a recording type, is invaluable in maintaining the necessary temperature controls.

Proper care and maintenance of metal handling equipment, such as hand ladles, bull ladles, melting furnaces and holding furnaces, is essential to the production of quality castings. All such equipment must be kept clean and free from oxide buildup and skulls to minimize possibility of dross inclusions in the castings. With refractory equipment, provisions should be made to prevent chipping and spalling through careless handling so that castings made from metal handled in such equipment will not contain refractory inclusions. When iron or steel equipment is used, it should be protected against attack by the molten aluminum alloys by frequent coating with a suitable wash. Within certain limits iron is beneficial as a hardener for some aluminum alloys. Excessive iron content resulting from pickup through handling in unprotected iron equipment, however, can cause reduction of mechanical properties and high scrap losses from shrinkage.

Fluxing operations, employing either inert gas or salt fluxes, must be carried on under controlled conditions for best results. Fluxing is usually done in the foundry to reduce the gas content and dross in the metal. It may also be used to alter the chemical composition of aluminum alloys with respect to magnesium, sodium and calcium. When a gas (nitrogen, chlorine or helium) is used for fluxing to remove dissolved or absorbed hydrogen, the gas as well as the tubes through which the gas is introduced into the molten metal must be completely dry. Moisture in the system will result in a gassing rather than a degassing operation. Controlled fluxing operations are aids to the production of quality castings. Uncontrolled fluxing operations may enlarge the defects they are expected to eliminate.

In sand foundry operations the control of moisture and permeability of the sand mix are important. Too much moisture can result in castings having a large amount of gas porosity. Excess moisture may also have an adverse effect on the surface appearance of the castings. Insufficient moisture may result in crumbling and washing of the sand, causing sand holes and/or lumps of metal on the casting surface at points where the sand has fallen away.

In permanent mold casting, the mold washes must be compounded to provide the required insulating effects and durability. Any solids included in such washes should be finely divided and the washes applied to molds in such a way as to provide a smooth even surface along with the necessary insulating characteristics. One-piece cores and pockets in a mold cavity may require a wash with some lubricating characteristics to provide easy core or casting removal with a minimum of dragging, galling and breakage.

All of the foundry practices discussed, as well as others not mentioned, must be under control if the foundry is to produce quality castings acceptable to its customers.

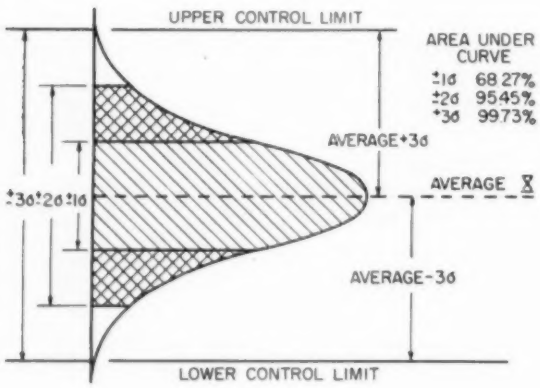


Fig. 4 (above)—Normal distribution curve rotated 90 degrees to form x control chart

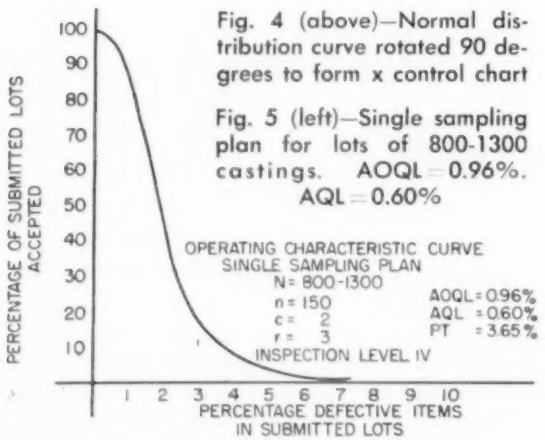


Fig. 5 (left)—Single sampling plan for lots of 800-1300 castings. AOQL = 0.96%. AQL = 0.60%

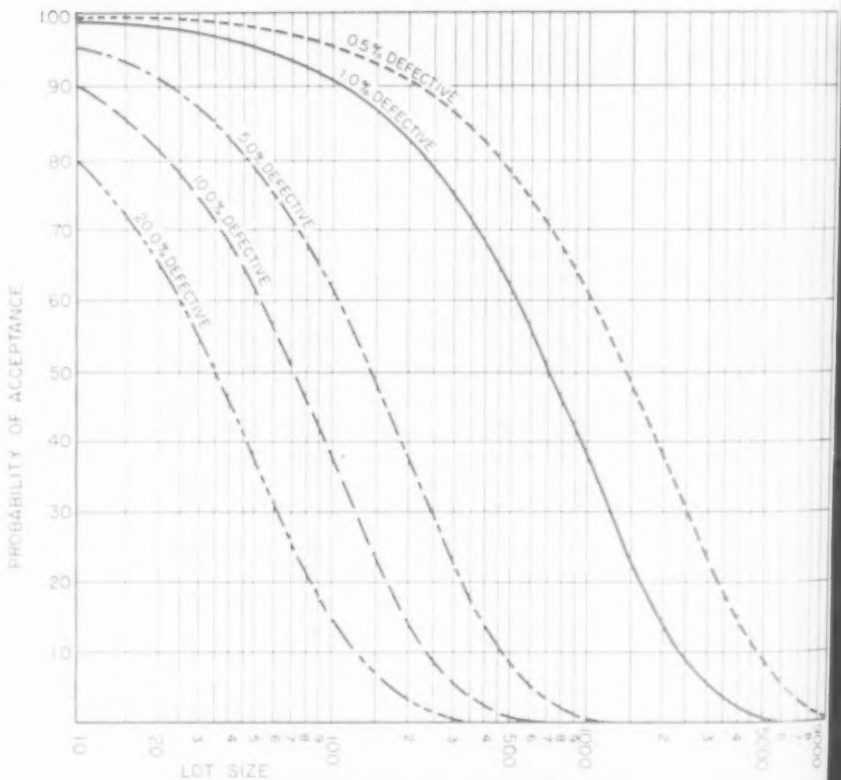


Fig. 6—Chart showing probability of acceptance of casting lots for various levels of quality

Inspection Methods—With the foregoing design details and foundry practices under control the production of quality castings would appear to be assured. Unfortunately, however, the men, materials, equipment and processes which are combined to produce the castings are variable in nature. As a result, normal foundry practice controls may sometimes be ineffective in maintaining desired quality in all castings. For this reason, inspection methods must be used to detect those castings that fall below this desired quality level.

Inspection methods generally used in quality control of aluminum alloy castings can be divided into two general classifications. First, there are the destructive methods—fracturing and sectioning of castings, machining, chemical analyses of a section of the casting, breakdown testing, microscopic examination of specimens removed from the castings, and mechanical testing of test specimens machined from critical sections of representative castings. These methods, as the name implies, result in the loss of the castings being inspected. This fact, of course, precludes their use as general inspection procedures, yet such methods are invaluable in establishing gating practices and in exactly locating those defects indicated by other inspection means.

Sectioning and machining castings is a simple, inexpensive method of inspection for internal defects. The accurate location of discontinuities is required for their removal and, in the case of small discontinuities in certain castings, the location of the defect may be the difference between acceptance and rejection of the casting.

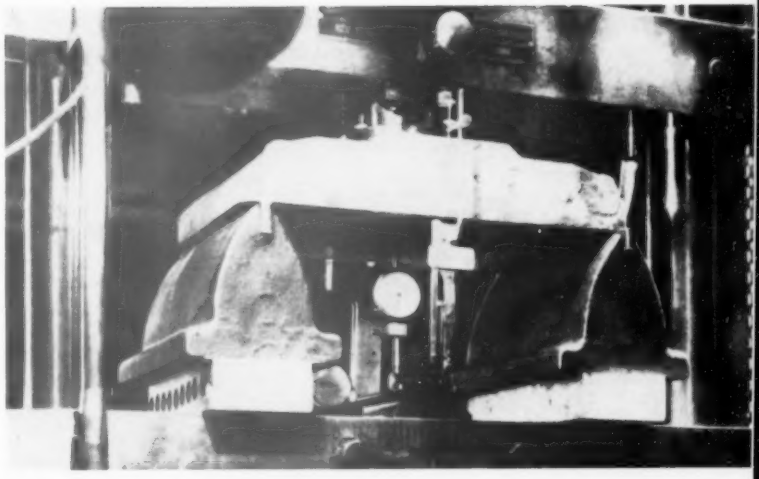


Fig. 7—Proof load testing a portable road scale base. Strain gages and dial indicators in place

Microscopic examination is another means of checking the seriousness of known defects. Such examination may show that an apparently serious discontinuity is merely superficial, or that a defect may have serious proportions. In either case, the findings suggest the proper corrective action.

Nondestructive inspection procedures include visual examination, physical measurement by gages or layout, mechanical testing of specimens separately cast from the same inspection lots of metal as the castings, radiography, fluoroscopy, chemical analysis of separately cast representative specimens, proof load testing, spectrographic (*Please turn to page* 208)

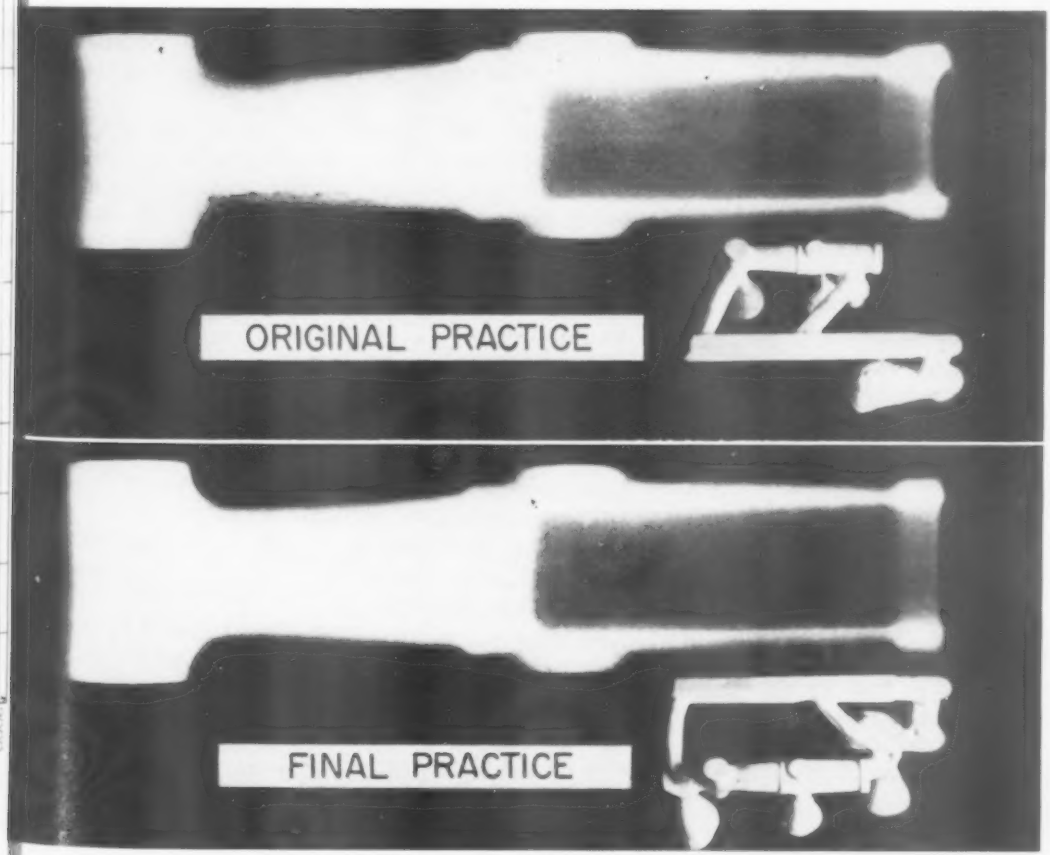


Fig. 8 — Top shows original gating and radiograph of casting disclosing shrinkage crack. Bottom shows final gating and radiograph of sound casting

Some of the requirements of a suitable brake drum material, and the metallurgical factors involved in its selection, are discussed by the author in this first of two articles. The paper was presented at the annual meeting of the Society of Automotive Engineers held in Detroit, Jan. 9-13

Brake Drum Materials

By FRED J. WALLS
International Nickel Co. Inc.
Detroit

THROUGHOUT the histories of the automotive and aviation industries, nearly every known metal in combination with its alloying elements probably has been introduced into the components used in mechanisms for converting motion energy into heat energy. While little has been recorded concerning the metals used to accomplish this conversion, much has been written about the mechanics of doing this job. According to Kerr and Frank[1], the U. S. Patent Office has issued approximately 5000 patents covering brakes.

The purpose of this paper is to discuss from the standpoints of physics and metallurgy, the problems involved in selecting a material for decelerating a vehicle.

For the sake of simplicity let us consider a brake as a device for the conversion of kinetic energy into heat energy and the necessary disposal of this heat. While the conversion part is relatively simple, usually accomplished by friction between a moving and a stationary surface, the disposition becomes involved and bothersome.

In our modern vehicles, because of design problems and the desire for the ultimate in appearance, a brake automatically becomes primarily a heat reservoir rather than a heat exchanger during ordinary usage. This is only true to a limited extent; that is, for the duration of a rapid stop, because the heat generated will be dissipated eventually in accordance with the laws of thermodynamics.

T. P. Chase of General Motors (now retired) in his paper before the SAE National Passenger Car and Production Meeting, Detroit, March, 1948[2], said:

"Everyone knows that brakes get hot, and engineers know that kinetic energy varies as the square of the speed, but very few have a realization of the heat equivalent of the energy possessed by a vehicle traveling at high speed.

"The kinetic energy possessed by a car in the smaller, low-priced group traveling at maximum speed is approximately 800,000 ft-lb, and the heat equivalent is 1050 Btu's. For the larger and faster cars the kinetic energy possessed at maximum speed is over 1,500,000 ft-lb, and the heat equivalent of this amount of kinetic energy is 1925 Btu's.

"The metallurgist's estimate of the amount of heat required to melt a pound of iron in the cupola is 550 Btu's. If 0.26 lb is used as the weight of a cubic inch of cast iron, 1050 Btu's of heat will melt a cube of iron $1\frac{3}{8}$ in. and weighing 1.9 lb. Similarly, 1925 Btu's will melt a cube $2\frac{3}{8}$ in. square weighing $3\frac{1}{2}$ lb.

"Another significant fact is that 75 per cent of the heat is developed during the first half of any brake application. This is the reason, plus the fact that the brakes must also overcome the force of gravity, that extremely high temperatures are attained on winding mountain grades where frequent retardation of speed is necessary."

Certainty of the ability to decelerate is far more important than the ability to accelerate in high-speed ground travel, because it involves the protection of human beings and priceless cargoes.

Frequently during the life of a vehicle, the horsepower required to decelerate may far exceed that available to accelerate. For example, in stopping a vehicle with a gross vehicle weight of 20,000 lb from a speed of 60 miles per hour at a deceleration rate of 10 ft/sec/sec there is converted 2,405,000 ft-lb of kinetic energy into 3090 Btu's of heat or approximately 495 horsepower consumed in stopping the vehicle.

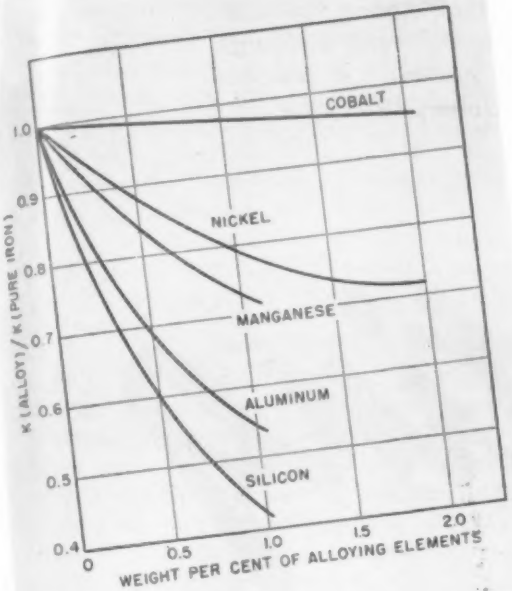
Probably this same vehicle was operating with a power plant of about one quarter this horsepower rating, thus giving a ratio of power required to decelerate to power to operate of 4 to 1. If this heat input were spread over a greater length of time, then our problems of suitable materials would not exist.

Let us consider the requirements of a material that would produce an ideal brake drum, and then proceed to the compromises which result from our inability to obtain all the requirements in a single material. The physical requirements can be listed as:

1. High thermal conductivity.
2. Low coefficient of thermal expansion.
3. High specific heat.
4. High melting or softening point.
5. High emissivity factor.
6. High coefficient of friction.
7. Low density.
8. Low modulus of elasticity.
9. High heat capacity per unit volume.

Why do we require these physical properties? Stated in simple terms the reasons are:

1. We require high thermal conductivity to avoid piling up the heat in a thin surface film on the friction



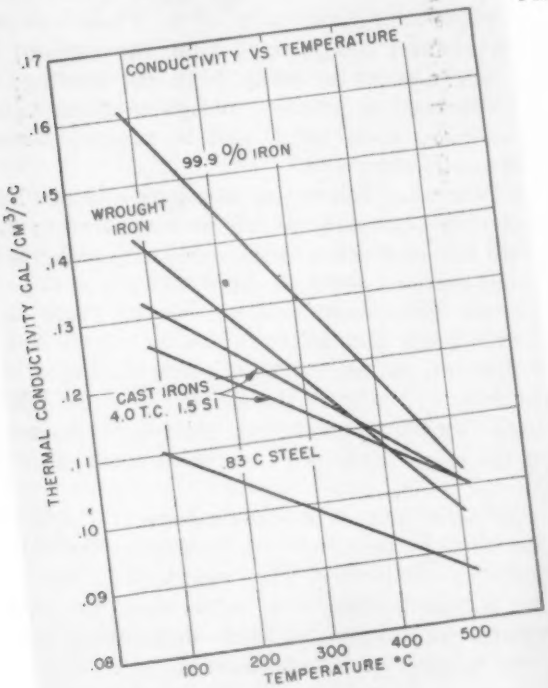


TABLE I—Average Properties of Some "Pure" Commercial Metals

Material	Thermal Conductivity Cal/cm³/°C		Thermal Expansion in./in./°F		Specific Heat Btu/lb/°F		Melt. Point °F	Emissivity		Density lb/in.³	Young's Modulus psi x 10⁶		Heat Cap'y Btu/in.³ per °F
Temp °C	25	500	20-100	20-500	20	500		Smooth	Oxide		25	500	
Aluminum 2 S	.52	.42	13.3	15.4	.22	.26	1220	.03	.07	.097	10	2.0	.02134
Copper	1.0	.9	9.3		.092	.098	1981	.18	.58	.324	16		.02981
Ingot Iron	.175	.12	6.5	9.0	.108	.16	2795	.40	.90	.284	28.5		.03067
Magnesium	.376		14.5		.25		1202			.063	6.5		.0157
Nickel	.22	.148	7.4	9.0	.11	.13	2651	.35		.322	30	28	.03542

TABLE II—Average Properties of Some Cast Alloys

Material	Thermal Conductivity Cal/cm²/°C		Thermal Expansion in./in./°F		Specific Heat Btu/lb/°F		Melt. Point °F	Emissivity		Density lb/in.³	Young's Modulus psi x 10⁶		Heat Cap'y Btu/in.³ per °F
Temp °C	25	500	20-100	20-500	20	500		Smooth	Oxide	20	25	500	20
Aluminum Alloy 3.19 6 Si 3.5 Cu Mn Al	.26		7.0	8.0	.23		1090	.03	.07	.101	10.3		.0232
Bronze SAE 420	.13		11.5		.092		1660			.296	15		.02823
Steel SAE 1020	.12	.09	6.5	7.8	.11	.16	2760	.20	.90	.284	30	17	.03124
Cast Iron	.13	.10	6.3		.13	.16	2150	.20	.90	.255	12	9.4	.03315
Invar	.026		.6	5.2	.123		2600			.26	21		.03198
Dowmetal "C" 9 Al.2 Zn.Mn	.17		.14		.25		1100			.066	6.5		.0165

TABLE III—Brake Drum Loadings

Type of Unit	Passenger Car*	Truck and Trailer*	Bus*	Plane-1942**	Plane-1949**
Total weight stopped (lb)	4190	45,750	27,150	50,000	162,500
Speed from which stopped (mph)	70	40	70	72	138
Time taken for stop (seconds)	10.28	5.87	10.28	10.6	20.1
Total swept area of drums	277	1902	1277	301	2836
Total weight of drums (lb)	50 est	220 est	640 est	88	796
Total energy, ft lb x 1000	685	2440	4430	4442	93,000
Total horse-power absorbed	121	757	780	762	8370
Hp absorbed per sq in. swept area	.43	.40	.62	2.5	3.0
Hp absorbed per lb drum	2.4	3.4	1.2	8.7	10.5

* Data from "Trend in Heavy Duty Brakes," C. S. Ricker, March 1949. ** Data from private communication.

Fig. 1 (above)—Illustrating the influence of impurity on the thermal conductivity of iron. (Adapted from Austin, *Heat Flow in Metals*)

Fig. 2 (below)—Showing the decrease in thermal conductivity of iron and steel with increases in temperature. *Alloys of Iron and Carbon*, Vol. II, F. T. Sisco, p. 581)

face to such an extent that the melting point of the material might be reached.

2. We require a low coefficient of expansion to minimize thermal stress between the inside and outside of a drum.

3. We require a high specific heat to store or absorb the high input of heat with a minimum temperature rise.

4. We require a high melting or softening point to avoid seizure of brakes.

5. We require a high emissivity factor to dissipate the heat by radiation. This is important in applications where prolonged or frequent braking is necessary to overcome the force of gravity but of little value in a single rapid deceleration.

6. We require a high coefficient of friction to minimize hoop and radial stresses.

7. We require a low density to minimize unsprung weight.

8. We require a low modulus of elasticity to minimize stresses due to differential dimensional changes caused by thermal gradients.

9. We require a high heat capacity per unit volume because of space limitations.

Table I lists the numerical values of the above physical properties of a few selected pure metals taken from recognized sources. It is well known that, for many reasons, pure metals are seldom used in industry, except possibly in corrosion and electrical applications. If the mechanical properties of pure metals were such that it were possible to take advantage of their desirable physical properties, our heat problems in brake drums would be minimized. Pure iron and pure copper are examples of metals that have been tried without any degree of success because of poor galling characteristics, if for no other reason; but if we study (*Please turn to page* 182)

Continuing their investigation of flow characteristics of molten metal in sand molds, the authors report here on factors influencing metal discharge into a mold cavity through finger and step gating systems. A previous report on this program was presented in the October, 1948 issue

PRINCIPLES OF *Gating*

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and
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IN ATTEMPTING to evolve principles applicable to gating system design, a program was undertaken to study flow characteristics of molten metals in sand molds. The investigation reported here is part of that program. A previous report ("Gating Systems for Metal Casting", THE FOUNDRY, October, 1948) showed that many gating systems do not function as commonly supposed. The present report deals with factors affecting the uniformity of discharge of molten steel into a mold cavity through multiple openings in a horizontal plane—as in finger gating systems—or which determine the sequence of flow through openings in a vertical plane —as in step gates.

Motion photography of molten steel being discharged into mold cavities provided the basis for these studies. The most instructive views are incorporated in two colored sound films, "Finger Gating" and "Step Gating."

Procedure—Steel was poured at 3000° F into both finger gating and step gating systems. The flow and appearance of the metal as it emerged from the gates were recorded by 16-mm Kodachrome cinephotography at 64 frames per second. Studies were made in this manner of flow in finger gating systems having a finger-to-sprue-area ratio of 2 to 1. Flow was observed in runners designed to split the stream; in runners bent toward or away from the casting; in tapered runners; in runners designed so that the metal impinged upon itself, and in runners having enlarged sections or pools.

Metal flow was observed in step gate systems having each step separately joined with the sprue; systems with two or more steps in common junction with the sprue; systems which incorporated tapered sprues or reversed sprues, and systems having steps combined with pools and offsets. The technique in this study did not permit continued observation of the feeding from a step after the rising metal had passed that step; consequently, it was possible to determine only if the steps fed in sequence when reached by the metal.

Unless noted otherwise, dimensions of the gating systems studies were: (1) sprues and steps, 1 in. in diameter; (2) runner, 1 in. wide by 1 in. deep and rounded on the bottom by a radius equal to one-half the width; and (3) fingers, same shape as the runner with the appropriate dimensions.

In the step gating systems the steps were located 6 in. apart vertically. The casting used in the finger

1A

1B

SPLIT STREAM RUNNER — AREA RAT

gate studies was a 6x12x6-in. section cast horizontally, while in the step gating studies, a casting 18 in. high, tapering from 6x6 in. at the top to 4x4 in. at the bottom, was cast vertically. A plugged pouring cup was employed throughout, since previous work with high speed photography (1000 frames per second) showed that such a cup maintained more constant conditions.

The following sections are devoted to generalized observations and analyses of flow through the various gating systems.

Finger Gating Systems

Split Stream Runners: The gating system shown in Fig. 1 was so designed that the runner-finger intersections would act to split the runner stream into equal parts and thus force uniform feeding. In this system all the fingers fed practically from the beginning of pouring as shown in Fig. 1A. The flow through the finger was intermittent rather than steady. A rocking movement back and forth on the surface of the steel with absence of either swirling or rolling motion was observed. This is believed caused by the intermittent feeding.

For purpose of this report, mold turbulence has been differentiated into three types:

(1) Swirling—Caused by nonuniform flow, the axis of rotation being perpendicular to the surface of the metal and to the plane of the fingers.

(2) Rolling—Produced by uniform flow and characterized by a uniform flow on the surface of the metal from one side to the opposite. The axis of rotation of metal within the mold is horizontal and parallel to the plane of the finger and to the runner.

(3) Rocking—Produced by intermittent discharge and characterized by rocking back and forth of the metal in the mold.

For better observation of the flow in the fingers, the cope of the mold was removed (Fig. 1B). The intermittent nature of the flow is evident in the middle fingers. Absence of the cope affected the flow in that a greater quantity of metal entered through the outer fingers than when the cope was present.

Bent Runners—The four gating systems of Fig. 2 were designed to determine the effect on flow of changes in angle at the junction of the runner and fingers. With both ends of the runner bent back 45 degrees from the casting, most of the feeding during the very early stages was through the outer fingers, (Fig. 2A) producing swirling turbulence. A change to uniform flow conditions soon occurred as indicated by the development of rolling turbulence.

With the runner bent back only 30 degrees, initial feeding occurred through the outer fingers (Fig. 2B) resulting in swirling turbulence, while the outer fingers continued to feed most of the metal, as indicated by the persistence of swirling motion. Runners bent forward at angles of either 45 or 30 degrees (Figs. 2C and 2D) caused the outer fingers to do almost the entire feeding in the early stages of pouring. Uniform flow was obtained late in the pouring when the runner was bent at an angle of 45 degrees, but swirling turbulence prevailed throughout when the angle of the runner was only 30 degrees.

The system shown in Fig. 3 was designed to evaluate bent runners in connection with offset sprues. The runner in this case was placed at an angle of 45 degrees to the casting, and initially the farthermost fingers fed more strongly. Later, feeding became uniform through all fingers, as indicated

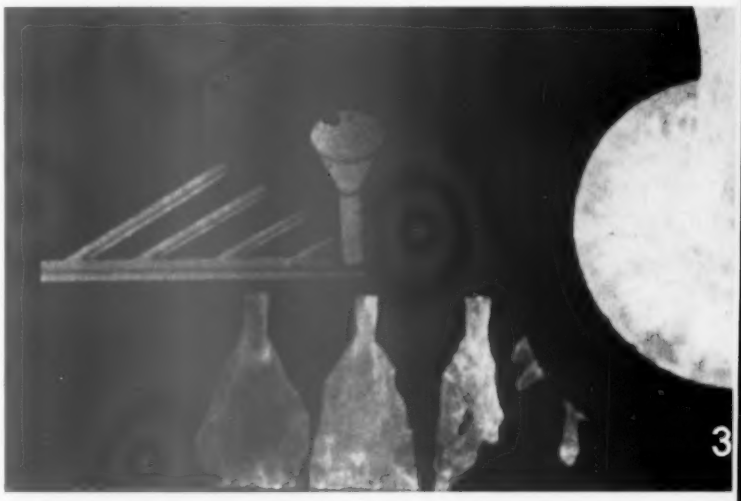
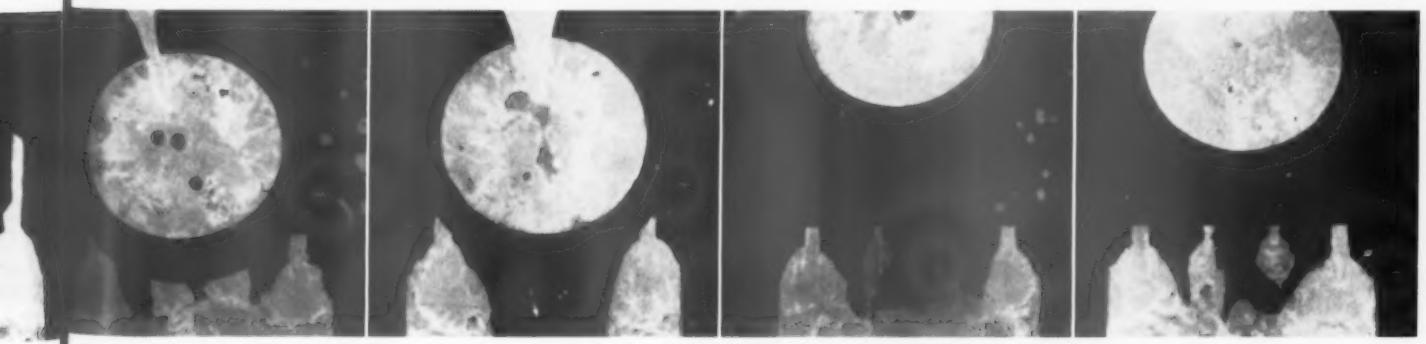
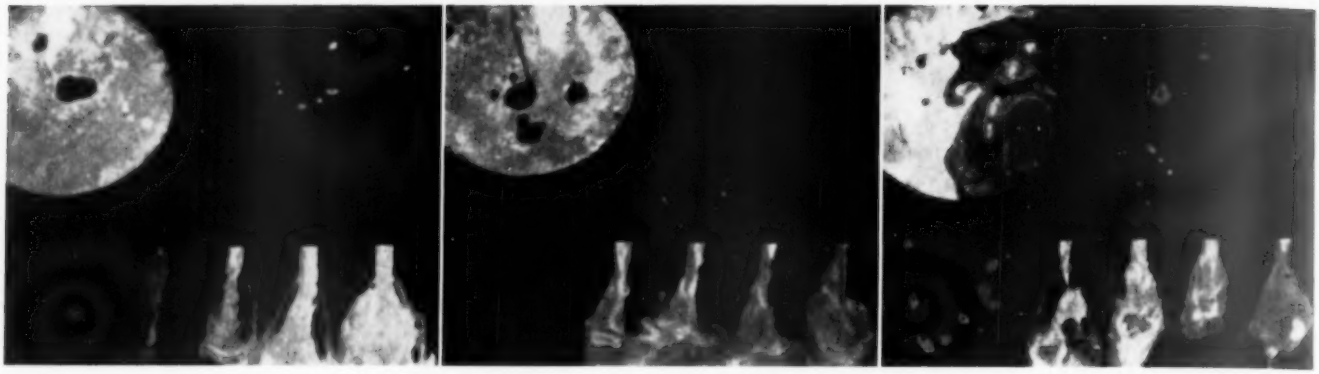


Fig. 3—Gating system designed to study use of bent runners in connection with offset sprues



BENT RUNNERS — AREA RATIO 2-1



4A 4B 4C

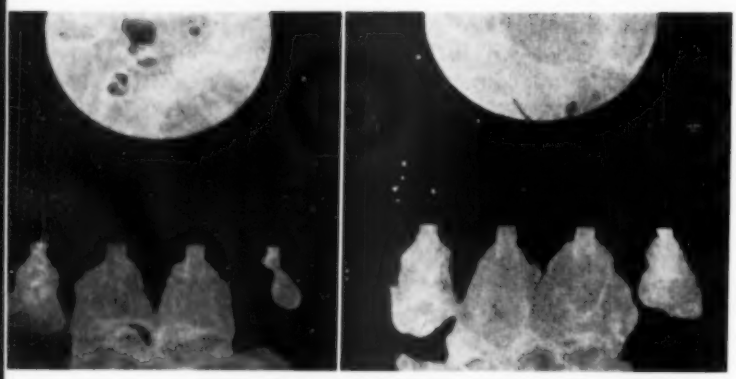
TAPERED RUNNERS AREA RATIO 2-1

by the rolling motion of metal in the casting.

Tapered Runners—The gating systems of Fig. 4 were designed to study the effects of tapered runners. The width and depth dimensions (square cross section) of the first system tapered from 1 in. to ¾ in. The sprue was located on the larger end. Initially, flow was stronger through the outer fingers (Fig. 4A) but uniform flow occurred later as indicated by rolling turbulence.

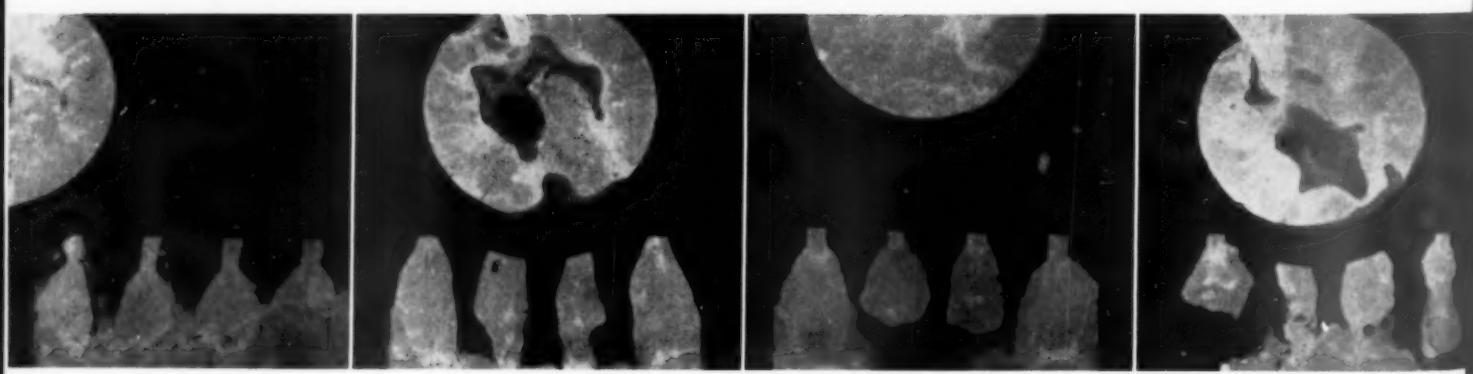
A taper modification to a ¼ in. (width and depth) at the small end produced a more uniform first flow (Fig. 4B) but not sufficient to completely prevent initial swirling turbulence. Uniform flow was developed later as manifested by rolling turbulence.

Fig. 4C shows the initial flow in a gating system in which the runner was step-tapered so as to reduce the volume abruptly at each finger junction. The over-all taper varied from 1 in. at the sprue to ⅜ in. at the end. The nearer fingers fed most strongly at first; later the farther ones carried the greater quantity of metal, and finally, as the mold cavity filled, the feeding became uniform causing the turbulence to change from swirling to rolling.



5A 5B

IMPINGING RUNNERS — AREA RATIO 2-1



6A 6B 6C 6D

ENLARGED SECTION RUNNERS — AREA RATIO 2-1

Impinging Runners—These runners were designed to effect a reduction of momentum by the collision of two metal streams. The arrangement shown on the left in Fig. 5 resulted in greater flow through the inner fingers (Fig. 5A). Uneven flow occurred during most of the pouring, changing to uniform flow only at the final stages of pouring.

Fig. 5B shows the initial flow from an impinging runner design having an enlargement at the point of impingement. This enlarged section was added so that the pressure wave generated at the point of collision could be dissipated. In this system, the inner fingers did most of the initial feeding, but uniform flow was established soon thereafter.

Enlarged Runner—Fig. 6 shows gating systems designed to permit the metal to reduce its momentum in an enlarged runner; Fig. 6A shows the effect of a single large pool. This system produced slightly uneven flow at first (emphasis is on farther fingers), but by the time the bottom of the mold was covered, all fingers fed uniformly and rolling turbulence resulted from the uniform flow.

Fig. 6B shows a system with a runner enlargement in the drag to form two separate, vertical pools. This system produced a slower and uniform flow almost from the beginning until the mold was filled.

Fig. 6C shows a runner with two enlarged sections in the horizontal plane. Flow was principally through the outer fingers as indicated by the swirling turbulence which continued throughout pouring. Reversing the pool as in Fig. 6D, to turn the flow away from the casting, resulted in some unequal feeding at first which later changed to uniform flow. With the cope removed, it was observed that the metal first swirled in the pools, lost part of its momentum and then flowed out fairly uniformly into the casting cavity.

Summary of Flow in Finger Gates—Figs. 1 through 6 shows it is possible to obtain uniform flow in "non-choking" finger gate systems, i.e., systems having a total finger area greater than the sprue area. This can be done by the use of gates which either split the fluid stream into equal parts or which absorb the momentum of the stream. The absorption of momentum can be best obtained by use of pools in the runner and with lesser success, by either bending the runner away from the casting, or tapering the runner.

Step Gating Systems

Since single photographs are not descriptive of the flow in step gating systems because of the continuously rising metal, a recourse was made to schematic representation of the chronological details shown by the film. These are presented as Figs. 7 to 11. The position of the arrowhead on arrows emanating from the upper steps indicate the level of metal in the mold when flow started from the step in question.

Inclination of the arrow from the bottom step indicates the path of the first flow from that step. The flow desired in step gating, termed sequence flow, is a relatively strong but quiet flow from each step as the metal level reaches it. Dribbling is not desirable because of the possibilities of sand erosion and the formation of cold shuts.

Single Junction Steps—The first system (Fig. 7A) was used as reference since it represents the most commonly used system. With this system all feeding was accomplished by the bottom step. Metal ran back into the middle and top steps. The remainder of the systems in this series are modifications of this basic system based on reversing or steeply inclining one or more of the steps.

To reduce the predominance of feeding by the bottom step, this step was inclined upward 60 degrees from the horizontal (Fig. 7B) thus simultaneously increasing the length of the step and introducing a sharp angle which offers more resistance to flow. This change produced sequence flow from the middle step but not the third. Inclining both of the two lower steps (Fig. 7C) did not produce sequence flow and moreover caused premature feeding from the middle step.

Figs. 7D, 7E, 7F show systems aimed at producing sequence flow with steps which curve downward from the sprue, and with curved steps in combination with inclined steps.

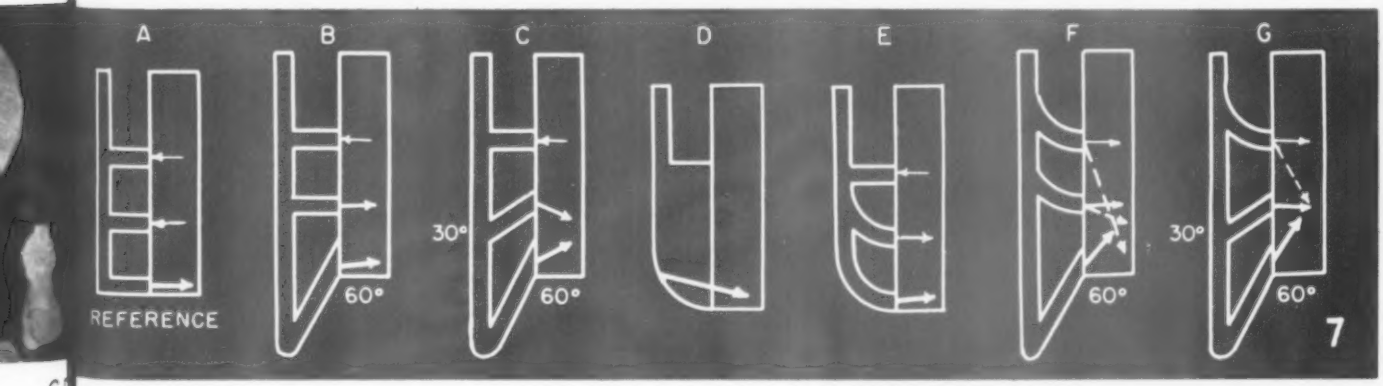


Fig. 7—Various types of step gating systems. Arrows indicate both direction and force with which metal moves through various steps in filling mold cavity

	FLOW	DRIBBLE
STRONG	→	---→
MODERATE	→	---→
WEAK	→	---→

The first gating system (Fig. 7D) illustrates a continuous step gate which is sometimes used commercially. It is claimed that in such a gate the first metal will follow the contour of the gate and subsequent incoming metal will be deflected by the metal in the gate so that feeding occurs at continuously higher levels during pouring. However, this gate acted to deflect the metal to the bottom of the mold cavity throughout pouring. The second system (Fig. 7E) divided the continuous gate into three steps but the top step did not feed properly.

Combining steps that curve downward from the sprue with reversed angles, as in Fig. 7F, produced limited sequence flow from all three steps. However, dribbling occurred from the curved steps prior to flow. To eliminate dribbling, the middle step was changed from a downward curve to a straight gate inclined upward 30 degrees (Fig. 7G). With this system the bottom step discharged metal forcibly when pouring started; the middle step did not dribble, but fed when the metal level reached it; the top step, however, still dribbled, but fed in sequence when the metal level approached it. Thus limited sequence flow can be obtained from a three-step system when the top step is curved downward and the lower steps are inclined upward.

Tapered Sprues—The next series of gating systems (Fig. 8) shows the effect of tapering the sprue. The straight step gating system (Fig. 8A) is used as reference. Flow through gates attached to sprues which had a direct taper (from 1 in. at the top to ¾ in., ½ in. and ¼ in. at the bottom, Figs. 8B to 8D, respectively) was sequential to a limited extent only for 1-in. to ¾-in. taper. The more severe tapers resulted in almost simultaneous flow through the three gates.

The first reverse taper system (Fig. 8E) was a big-end-down sprue tapered from a 1-in. diameter at the top to 4 in. at the bottom. This system was not successful. A milder reverse taper system (Fig. 8F) had the sprue tapered from 1-in. diameter at the top to only 2 in. with a pool at the bottom. Again the system was not successful.

The experiments corroborated deductions relative to finger gates; namely, the amount of sprue taper necessary to produce the desired flow pattern is critical and would be difficult to control. Reverse tapers (which may also (*Please turn to page* 204)

Fig. 8—System showing effect of tapering the sprue. Fig. 9—Two or more steps are slanted upward from a common junction at the sprue. Fig. 10—Showing how step gating systems function with reversed sprues. Fig. 11—Systems studied in which pools or offsets failed to develop sequence flow

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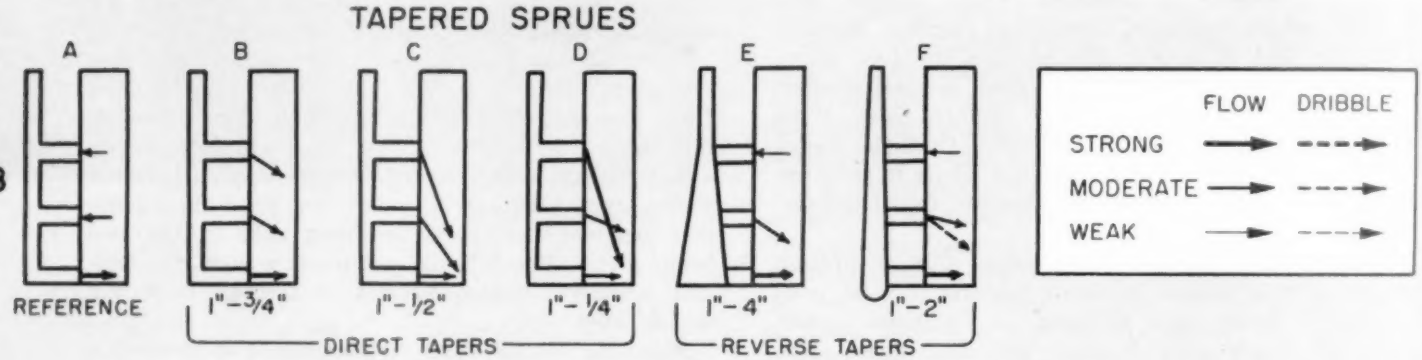

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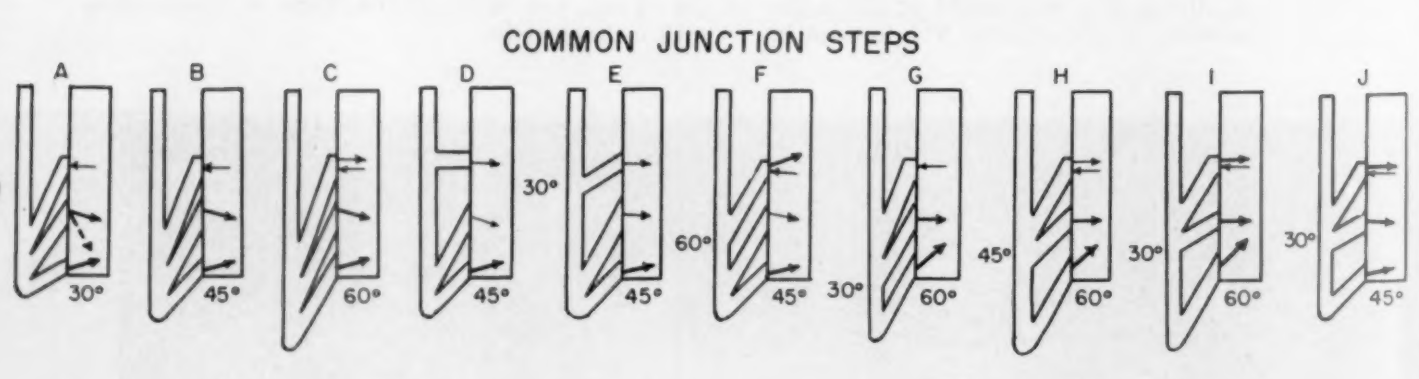

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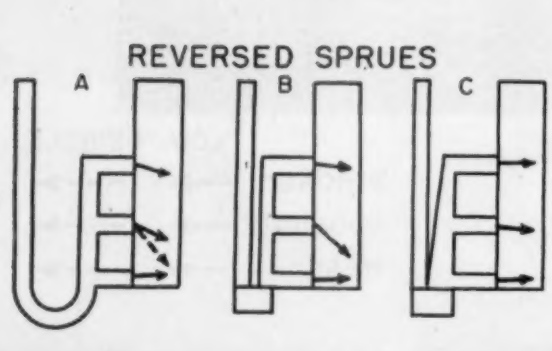

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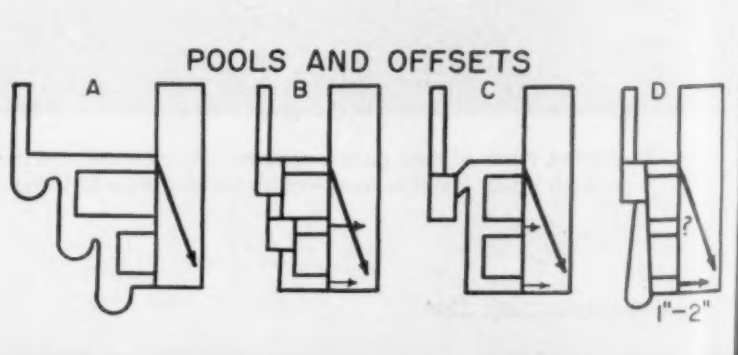

By JOHN HOWE HALL
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Swarthmore, Pa.

STEEL FOUNDRY

Core and Molding Sands

Functions of cores, and properties and proportions of materials used in core sand mixtures, are described in this fourth of a series of articles on sand practice in steel foundries. Next month the author will discuss molding sand

SHARP (clay-free) sands are used in making oil-bonded cores, and since mixtures of sharp sand and oil have almost no green strength, other binders must also be used to give the sand in the "green" state enough strength to make the cores stand up when taken from the boxes. For this purpose, cereals, proteins, etc. are generally used, in amounts sufficient to give just enough strength to keep the cores from collapsing.

Bonding power of linseed oil results from its ability to oxidize at comparatively low temperatures to form a strong, tightly adhering dry film on the sand grains that holds them tightly together. When dried at the correct temperature, the moisture added to the sand is completely driven off, and the dried film of oxidized oil produces but little gas when subjected to the heat of the steel. To develop the highest strength in the core the temperature at which oil-bonded sands should be baked varies from a low of 350° to a high of 475° F; 450° appears to be the best baking temperature for many oils on the market. To determine the most suitable time and temperature at which to bake a sand mixed with a given oil, sample cores should be baked for varying periods at several different temperatures and the resulting strengths determined.

The rate at which different oils harden on heating, and the depth to which satisfactory baking takes place in a given length of time, also vary considerably. A test recently developed to check the baking rate of various oils, is to make a cubical core approximately 3-in. on a side, using a sharp sand kept on hand for the purpose, and set it on a flat drying plate. After this core is baked a definite time at a fixed temperature, it is allowed to cool, and is weighed. All loose sand at the middle of the side that was in contact with the plate is scraped out with a spoon, the remaining firm sand is weighed, and the percentage of properly bonded sand is calculated. A low percentage of well-bonded sand is of course an indication of an unsatisfactory oil.

When exposed to moist atmosphere, baked cores tend to absorb moisture and lose some of their strength. Of core oils on the market, those with a high proportion of linseed oil appear to be the least affected by moisture absorption. Loss of strength from this cause may be checked by apparatus in which test cores are held for a fixed time in an atmosphere practically saturated with moisture, and their strength then compared with that of check cores of the same mixture tested immediately after baking.

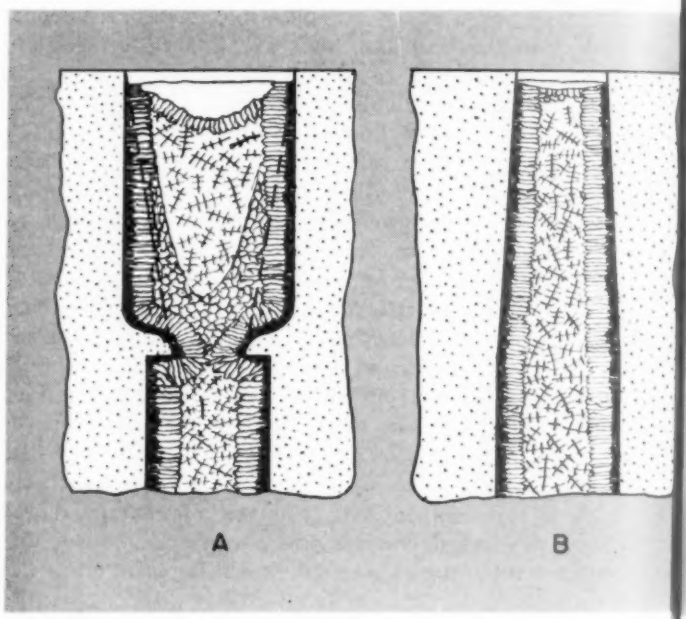
Core Sand Mixtures—As explained in the earlier discussion of molding methods a core may be anything from a small body of sand almost completely surrounded by metal, to a block several feet long, wide and thick which forms a part of a mold made by the core-assembly method. The large draw-backs rammed against a pattern are also sometimes classed as cores. Type of sand used for a core, therefore, depends entirely upon what sort of a core it is. Sand mixtures for facing heavy cores making up core assemblies and for large draw-backs, are much the same as those used in dry sand molds, which will be described a little later. In green sand molds, too, there are often large portions of the outside surface of the casting, so shaped that they will not draw and cannot be formed by loose pieces on the pattern, and fair-sized cores are required at these points. In many cases these cores are not dried, but are made of the same mixtures as the rest of the mold. They are generally sprayed with dilute lignin solutions, allowed to air-set, and placed in the mold by the finishing gang.

Cores almost completely surrounded by metal are a very different matter from these exterior cores and draw-backs, which present no problem in venting off the gases generated by the heat of the steel, since it is easy to carry adequate vents out to the air. Getting the gases out of cores buried in liquid metal, however, requires that the sand be highly permeable, so that as fast as the gas is generated it can reach vents extending the full length of the core and connecting through the core print or prints with vents made in the sand of the mold. Cores of this type are most often made of oil and "sharp" sand mixtures. Washed and dried sands now available in many districts serve admirably as base material for oil-bonded cores of this sort, since they contain no fine silica or clay to reduce their permeability, and can be obtained in any desired range of grain sizes.

As indicated, cereal, casein or similar bonds must be used with the oil, to (*Please turn to page* 212)

Fundamentals of Feeding For Sound TIN BRONZE C

Principles of riser design to insure adequate feeding of metal to the solidifying casting are discussed in this third of a series of four articles. The concluding article, to be presented next month, will describe the use of chills and antichills in the production of sound tin bronze castings



THE preceding discussion (THE FOUNDRY, May, June) has indicated the necessity for risers, the figures used so far showing the usual open type. Of all the variables which may be introduced into the production of a casting, the correct riser design and placement has usually been considered to have the most important bearing upon the soundness of the casting. This may be true, but a number of examples of risers illustrated so far in this series of articles would have had little or no effect upon preventing the formation of shrinkage. No riser, regardless of how well it may be designed, can produce a sound casting if we have gassy metal, if the wrong system of gating is used, or if other important variables have been overlooked. In spite of, or perhaps because of, this interdependence of all variables, it will be wise to give a rather detailed discussion of riser design.

The chief purpose of any riser is to provide a reservoir of molten metal which will be available to the casting as long as there is any feed demand resulting from the liquid and the liquid-to-solid shrinkage. A secondary purpose is to provide pressure to force the molten metal into the interstices between the dendrites. Both considerations must be kept in mind when designing a riser, one of comparatively large diameter probably being the best and the most economical insofar as providing metal for feeding is concerned. On the other hand, with higher risers more metal pressure is provided. Under all conditions, the metal remaining in a riser is wasted insofar as salable metal is concerned, therefore it is advantageous to keep the risers as small as possible, yet provide the necessary metal to make up for the amount of shrinkage involved and to provide the necessary pressure.

During solidification, the riser must be considered as part of the casting, solidifying in exactly the same way. The usual chilled skin will be formed, likewise the zones of columnar and of random growth. It is always hoped that solidification in the latter two zones of the riser will be sufficiently slow that complete solidification therein will not occur until the casting itself has solidified completely. It will be evident that a comparatively small proportion of the metal actually poured into a riser cavity will be available for feeding. If the riser could be prevented from freezing at all, all of the included metal would be available for feeding and the riser could be made much smaller.

As Caine[1] has pointed out, there are limits to the

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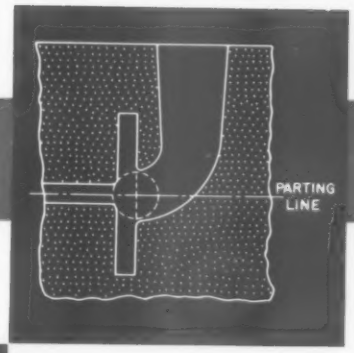
CASTINGS



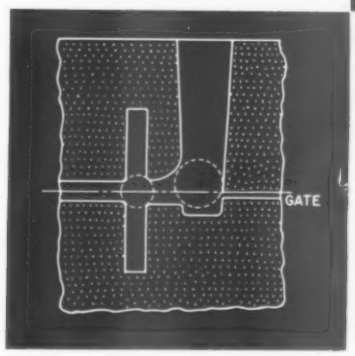


Fig. 7 (above)—Correct design for parting line riser. Fig. 8 (left)—Incorrect design for parting line riser

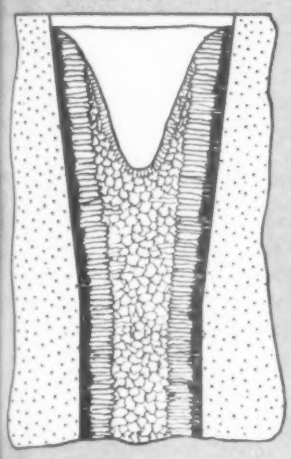


Fig. 6 — Open riser design. *A* and *B*—Incorrect design. C—Correct design

distance any riser will feed. Although the actual distance is not known with any real degree of accuracy, it can probably safely be considered as being approximately three to five times the thickness of the casting wall immediately below the bottom of the riser. The larger distance would be about correct for those metals with strong piping tendencies, the smaller distance may be too high for metals like the bronzes which have rapid dendritic growth. Regardless of the metal, the actual distance is probably considerably less than is often expected. It need hardly be said that the riser must be large enough to feed this distance, but anything larger than the minimum actually required will fail to provide any additional feeding, no matter how large it is made. Excessively large risers are, therefore, a waste of metal as they impart nothing to the soundness of the casting except possibly by preventing freezing completely before the casting has solidified.

This comparatively short feeding range of the risers emphasizes the need for providing additional means of feeding those portions of the casting below and beyond this distance. In other words, means must be evolved which will insure that the casting itself will continually feed those areas lying below.

There is some difference of opinion concerning the design of risers themselves, some foundrymen using high narrow ones, others low and wide ones. Probably the best design lies somewhere between these two extremes, large enough in cross section to retain the metal in a molten condition at the center, and just high enough to prevent the final shrinkage from extending into the casting. Exponents of the high risers usually add the extra height to provide feeding pressure. If, however, the metal is gas free and poured at the optimum temperature, atmospheric pressure alone appears to be sufficient to force the metal between the dendritic branches and thus provide the necessary soundness. A thought which enters here is that high risers, to be effective, must be large enough in diameter to prevent freezing of the column of metal. As the riser increases in height, it must also increase in diameter and will soon reach extremely uneconomical proportions. If the riser freezes across too soon at any point, we not only lose the desired pressure exerted by the metal, but also that exerted by the atmosphere pressing upon the riser surface.

Open Risers—As stated previously, an open riser, to be completely effective, must increase in size con-

tinuously from the point where it joins the casting, clear up to the cope surface. The practice of using risers with parallel sides and which are necked down at the point where they join the casting, as shown in Fig. 6A is likely to result in incomplete feeding, especially with the tin bronzes. This type of necked riser is fairly common for gray iron and is sometimes used with other metals. Its only advantage lies in the fact it can be easily removed by breaking off at the neck. If we use the usual parting line gating, the coldest metal will be in the riser. The metal, passing through the narrow neck, may heat this neck somewhat, but not to the temperature of the last metal which enters the mold at the parting line. It is likely that solidification will begin at, and will quickly freeze across, the narrow neck, completely shutting off all feeding to the casting.

Such a necked riser cannot completely feed a tin bronze with its rapidly growing dendrites, therefore its use must result in shrinkage. Shrinkage should be avoided if, instead of the necked-down area, the bottom of the riser is the same as the thickness of the casting wall where it is attached, as indicated by Fig. 6C, and the riser walls tapered outward as we approach the surface of the cope. The use of parallel sides which flare inward to the thickness of the casting would probably feed as well as the tapered riser. However, in such a parallel-sided riser, all metal outside the area of a straight taper from bottom to top would be wasted. As an illustration, all metal outside the dotted lines in Fig. 6A is wasted insofar as feeding is concerned and represents metal which has been melted and gives no return, either as salable castings or for providing the required soundness.

Fig. 6B illustrates a riser design often seen. This design is used chiefly for risers mounted on the pattern, the reversed taper being provided to obtain a simpler pattern draw. It is evident that such a riser will freeze off at or near the surface and cannot provide the necessary feeding with any type of metal. Both Figs. 6A and 6B illustrate the impossible principle of trying to feed a section through a smaller section. Very little molder's time is saved by using a riser with a reversed taper. By tapering the opposite way, the riser pattern could be dowelled to the main pattern, molded in the usual way, and withdrawn through the cope before the cope is drawn.

Fig. 7 illustrates the correct design for an open riser located at the parting line, the design being in accordance with the principles derived during the previous discussion. The drawing illustrates an ordinary "T" section being fed by a riser placed at the intersection. The dotted circle, centered at the outside surface of the casting proper, indicates the size of the hot spot resulting from the enlarged intersection plus the riser neck, all of which must be fed by the riser. To obtain the necessary feeding, the riser neck must be somewhat larger than this hot spot, then the riser must increase gradually and continuously in size as it approaches the top of the mold.

At first glance, it will appear that the neck, where the riser joins the casting, is excessively large for such a section. It must be admitted that it really is large, but any neck smaller than the inscribed circle will fail to feed the "T" section. This design should be compared with that shown in Fig. 8, illustrating a side riser design which is most commonly seen, first because it is much easier to mold than the continuous taper of Fig. 7, but also it would probably seem to the majority of molders that it should feed the area satisfactorily. Its use possibly accounts for most of the shrinkage and consequent leakage found at ribs and other such intersections.

The author is not criticizing anyone using such a design as he has used many such risers himself, never thinking that a large neck, with a diameter almost three times the thickness of the casting wall, would be necessary to feed the section. We should consider the smaller inscribed circle in Fig. 8, which indicates the hot spot which will be formed when the mold is full. It will quickly become evident that the smaller neck cannot feed this hot spot. For emphasis, it is repeated that, to determine the correct neck diameter, the inscribed circle must be centered at the external face of the casting where it joins the riser neck, then the neck must be slightly larger than

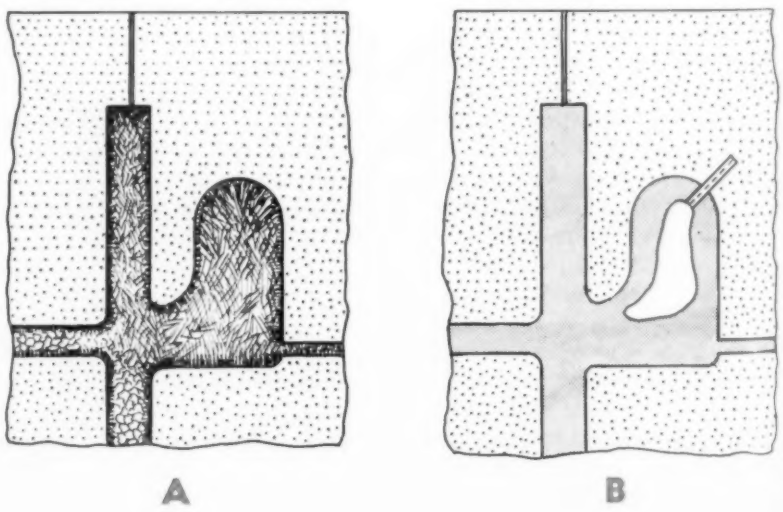


Fig. 9—Types of blind risers. *A*—Common type, shrinkage extending into casting. *B*—Williams riser with "fire-cracker" core

the diameter of this positioned and inscribed circle.

Another possible source of trouble is indicated by the larger inscribed circle. This circle is larger than the diameter of the riser immediately above it. Unless all conditions are correct, the riser may freeze off above this hot spot before the casting and the riser junction have frozen completely. This being the case, shrinkage will likely extend into the casting. This combination of circumstances can result if a large quantity of metal has flowed past the junction, heating it to a temperature high enough to retard solidification at this point. As the mold cavity has been filling, the metal will have been coming up in the riser, cooling all the time. This cooler metal may be the first to freeze, the hottest metal then being located in the area indicated by the two circles and in the neck area between.

Probably the greatest objection to the use of the design illustrated in Fig. 7 results from the difficulty in obtaining a suitable pattern draw. It is often impossible to arrange this shape of riser upon a flat pattern plate. Sometimes it will be possible to arrange an uneven parting line to take care of this; in other cases it may be necessary to insert a ram-up core.

As stated previously, regardless of the size or shape of riser used, it is necessary that it be kept open to the atmosphere until solidification of the casting is complete, if we are to obtain the full benefit of the riser with consequent soundness of metal under it. Numerous methods are more or less effective for the purpose. In deciding upon a suitable method, we must take into account the possible effect the method may have on the composition of the metal in the riser. It would be a fairly simple matter to add a substance such as granulated zinc to the riser and which would combine with the metal to reduce its freezing point and thus keep it longer in the molten condition. As it is usually planned to remelt the risers, we must be careful not to add anything which, by alloying with the metal, would make it unfit for further use. This consideration will narrow our choice of suitable "riser compounds" considerably. (*Please turn to page* 199)

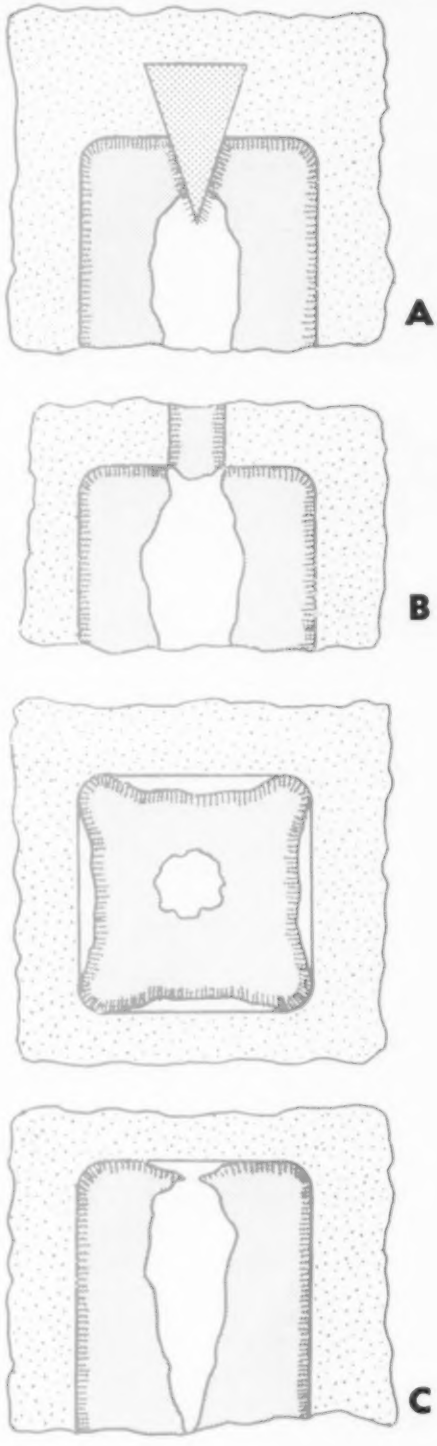


Fig. 10 (left)—Application of blind risers to bronzes. *A* — Low riser showing "drawing in" due to barometric action. *B*—Correct design using high riser

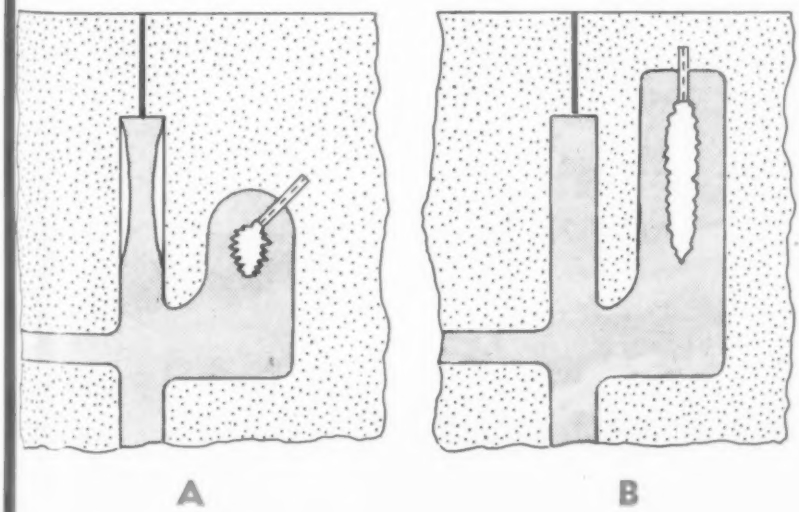
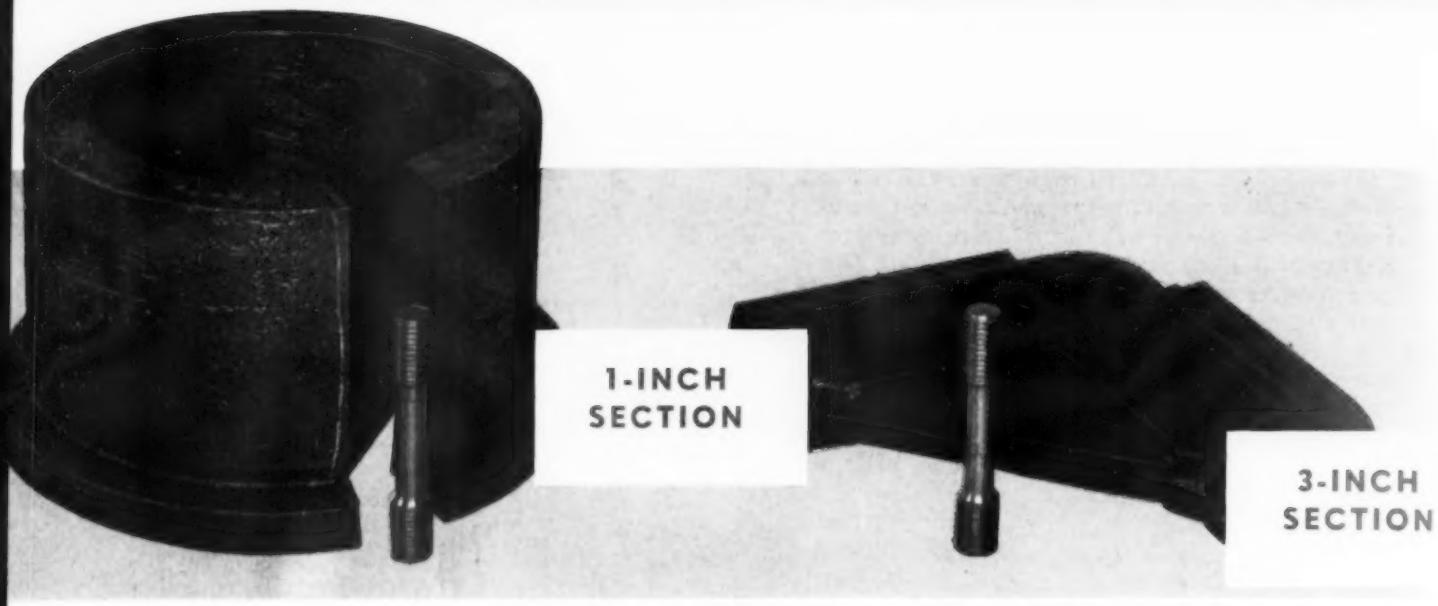


Fig. 11 (above)—Blind risers suitable for bronzes. *A*—Wedge core to form hot spot to initiate feeding. *B*—Hot spot formed by large vent. *C*—Feeding initiated by atmospheric pressure on weak skin



By EDWARD M. STATE
President
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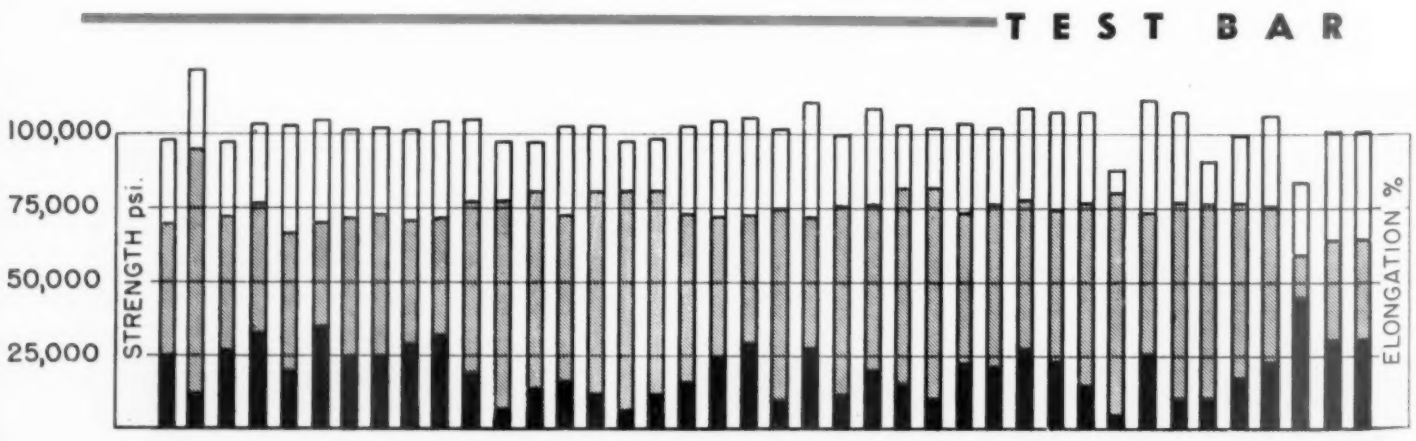
SOME EXPERIENCES IN

Producing Ductile Iron

STATE FOUNDRY & MACHINE CO. is a jobbing shop located at Cedar Grove, Wis., producing a variety of types of castings from a few ounces up to several tons in weight. In the past, quality plain and alloy gray irons have been poured; now magnesium-containing iron also is being produced.

About a year ago we heard fantastic claims concerning magnesium-containing cast iron. Together with these claims we heard many rumors concerning such production problems as: hazards of using magnesium, short time interval required between alloy addition and pouring of castings, special materials necessary, close metallurgical control, etc.

With full knowledge of all the above, none of which could be verified, it was decided to answer some of these questions from experience. This decision was based on the reasoning that even though the property claims might be discounted a great deal, this new material would still have considerable virtue. It was also considered probable that the production problems were exaggerated, and might be overcome without too much difficulty. It seemed unbelievable that such a development could lie idle, and that the potential for the foundry would not be great; if not at



Tests taken from several ladles on each of 22 days' production, representing one month and approximately 50% of metal poured

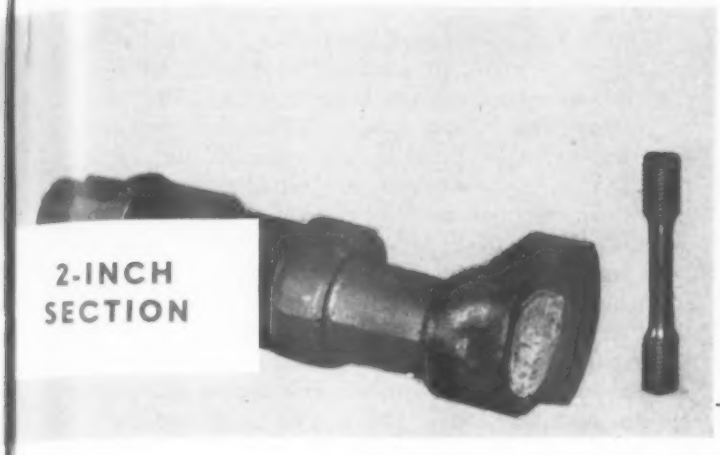


TABLE I—Comparative Properties from Various Sections in Castings and Keel Blocks

	TS	YS	E	Bhn
1" Keel block as cast	101,300	74,000	7.5%	241
1" Keel block annealed*	72,500	58,200	20.5%	170
1" Section casting as cast	99,500	75,000	6.5%	241
2" Section casting as cast	97,400	79,000	6%	235
3" Section casting as cast	95,000	71,000	4%	229

Analysis

C	Si	Mn	P	S	Ni	Mg
3.63	2.66	.40	.06	.014	1.13	.073

* 1650° F 1 hr. Cooled to 1275-1300° F and held 5 hr

Fig. 1—Test bars cut from castings of 1, 2 and 3 in. sections. Table I compares properties of these casting sections with those of 1-in. keel bars

once, it certainly would be within the foreseeable future.

Upon investigating further, it appeared mandatory that any foundry attempting to produce this material would necessarily require a laboratory to obtain chemical control and consistent results. It was decided that this course would be followed if necessary. However, we had always relied on commercial laboratory chemical and metallurgical tests for control and to prove our results. It seemed practical that such guidance, together with aid from the International Nickel Co., should suffice at the outset. It was then that application was made for a license to produce magnesium-containing iron under patents of the International Nickel Co., and the franchise was granted May 20, 1949.

As was expected on the first several experimental heats, the full anticipated results were not achieved, but the information gained on each heat helped to chart the course for those following. Surprisingly, before long we were able to develop physical properties equivalent to and even better than those claimed. Of this we were actually skeptical at the start. Ultimately a practice was set up for the production of ductile iron which has been followed ever since—except for some improvements in technique, and in some cases where the end use of the casting dictates an additional alloy content to produce a variation from the properties and microstructure found in our regular production.

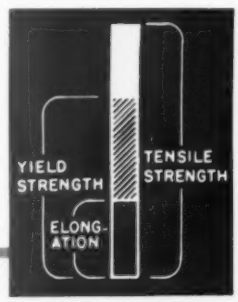
It should be pointed out that there has ceased to be anything fantastic or mystic concerning magnesium-containing iron. In the rare cases where any great deviation from the normal results occur, there

TABLE II—Chemical Analysis of Test Bars in Fig. 2

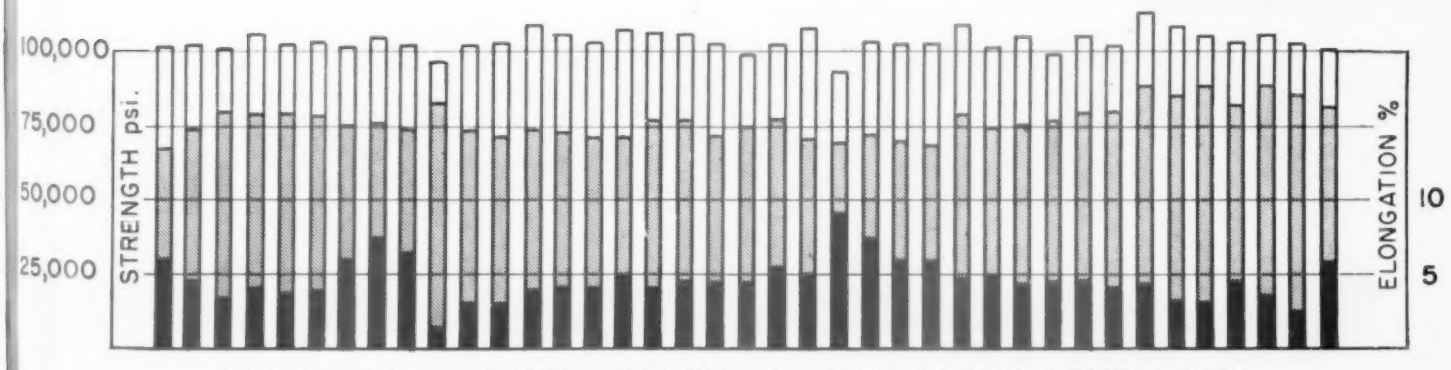
95% Spread		Average of All
3.57–3.81	C	3.67
2.29–3.01	Si	2.57
.36–.51	Mn	.46
.068–.109	P	.083
.010–.018	S	.013
.98–1.45	Ni*	1.25
.066–.11	Mg	.088

* One ladle alloyed to 3.24 Ni. Test bar shows tensile strength 122,500 psi, yield strength 95,000 psi, elongation 2.5%, and brinell hardness 285 in 1-in. section from keel block

Fig. 2 (below)—Physical properties of test bars representing one month's production. Chemical properties of these bars are shown in Table II



PROPERTIES



0.505-in. bars cut from 1-in. keel blocks; cooled to black in dry sand cores. Brinell hardness 217-262, average 248

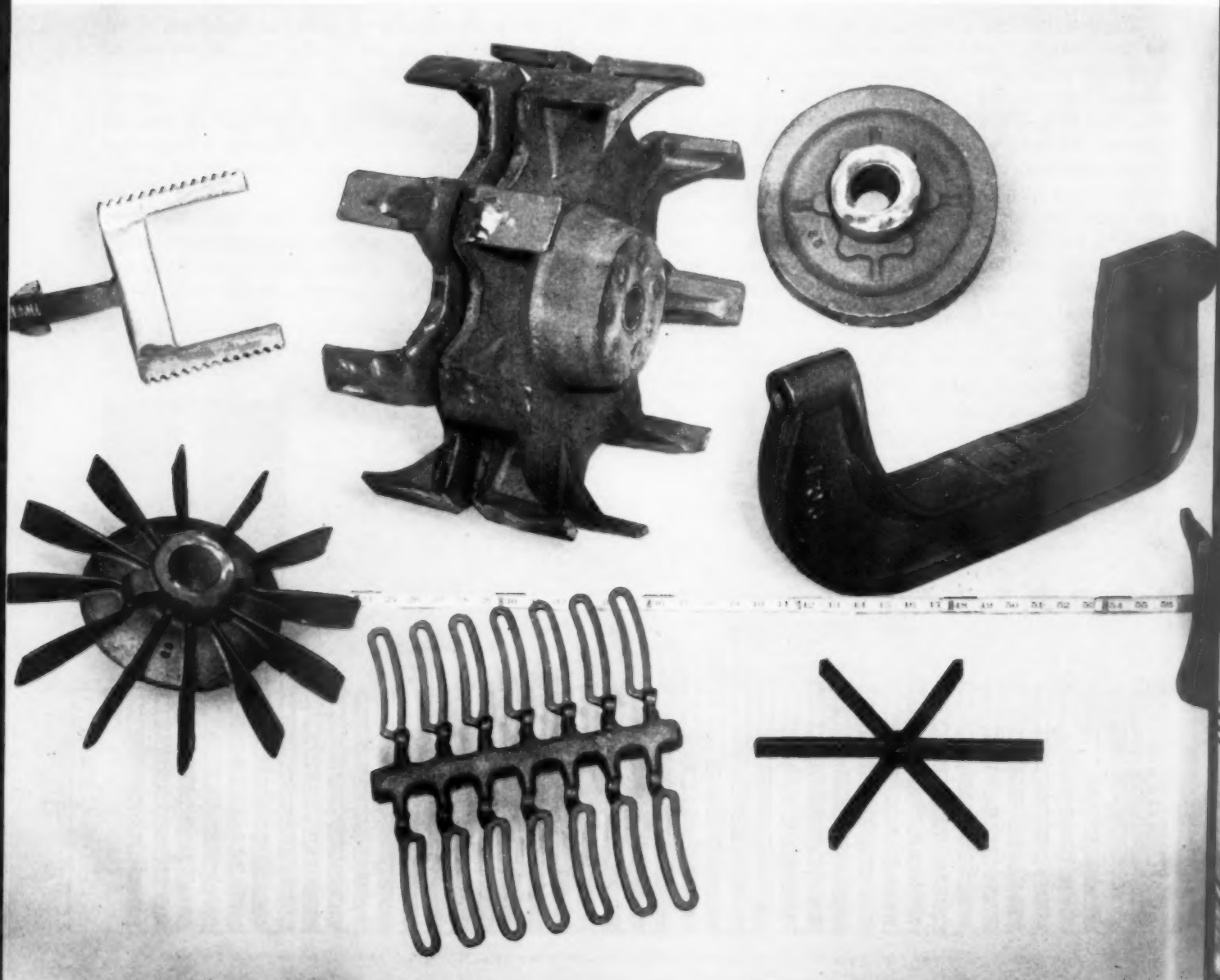
have been obvious reasons for it. Thus, concern over metal and properties was disregarded. Also it appeared that a laboratory was not a necessity, so long as adequate information on analysis and properties could be obtained by independent laboratories regularly.

During the course of solving the metallurgical problems, it became evident there was no pyrotechnic hazard with the alloy we were using, also that the metal would freeze in the ladle before any fading effect of the magnesium addition would be experienced. Exceptionally light castings have been poured at as low as 2450°F and, strangely enough, ran with no rejections. It was also found that the pattern shrinkage was very close to that for gray iron, and that the liquid shrinkage is greater in heavy sections requiring risers approximating steel practice, but considerably less in light sections.

Tests were made on 1-in. well fed keel blocks which have been compared with bars cut from 1, 2, and 3 in. sections of well fed castings, all made from the same ladle. These tests showed a relatively small decrease in properties with the increasing section. A duplicate of the test from the keel block also was annealed for comparison. These results are shown in Table I, and castings from which tests were made are shown in Fig. 1.

Coincidental with the main purpose of the experimental work, quick rough tests were made on welding and machinability, and these qualities were found to be very good. Heat treatment has also been tried experimentally, resulting in hardnesses as high as 588 bhn, by heating and quenching, while a short anneal has shown an increase in elongation to 20 per cent. Some favorable results have been obtained in a few tests on castings which have been flame hardened or quenched and drawn. Actually, little work has been done in the direction of heat treatment because our main interest lies in producing castings for shipment as cast, with a short anneal, or a simple tempering treatment.

In order to give an idea of the physical properties and consistency with which they can be reproduced, a chart of results obtained on all tests made for a full month has been included. See Table II for chemistry, and Fig. 2 for physical properties. Based on such



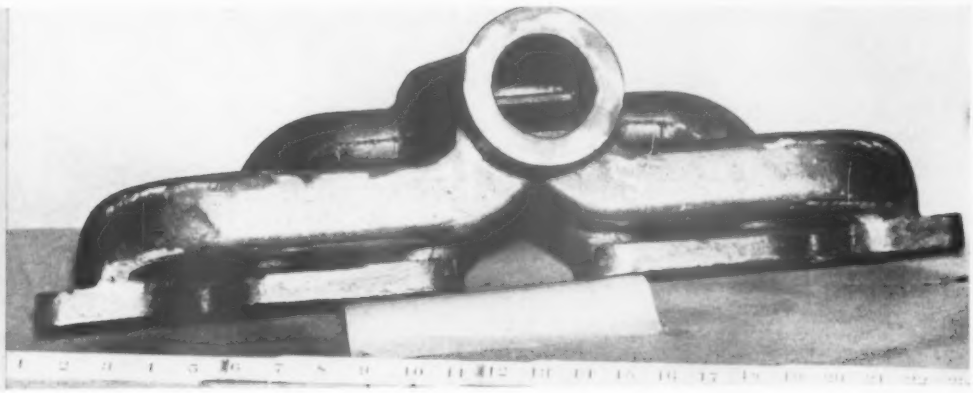


Fig. 3—This manifold for an internal combustion engine is cast from ductile iron

data, it is felt that castings can be furnished to minimum specification of 90,000 psi tensile, 65,000 psi yield strength, and 2 per cent elongation.

From experience we have learned that the occasional low elongation of 2 per cent and under comes from ladles which can be anticipated. These ladles are the first or last of the heat, depending upon position of the special cupola charges in the days run, and in which there is some possibility of contamination. Each of the several tests showing 2 per cent elongation and under on the property chart had some combination of low carbon, low silicon, high manganese, or high phosphorus as compared with the average. In cases where there is such a possibility, it is a simple matter to arrange to pour those ladles into castings destined to be annealed on account of specification or section of the part involved.

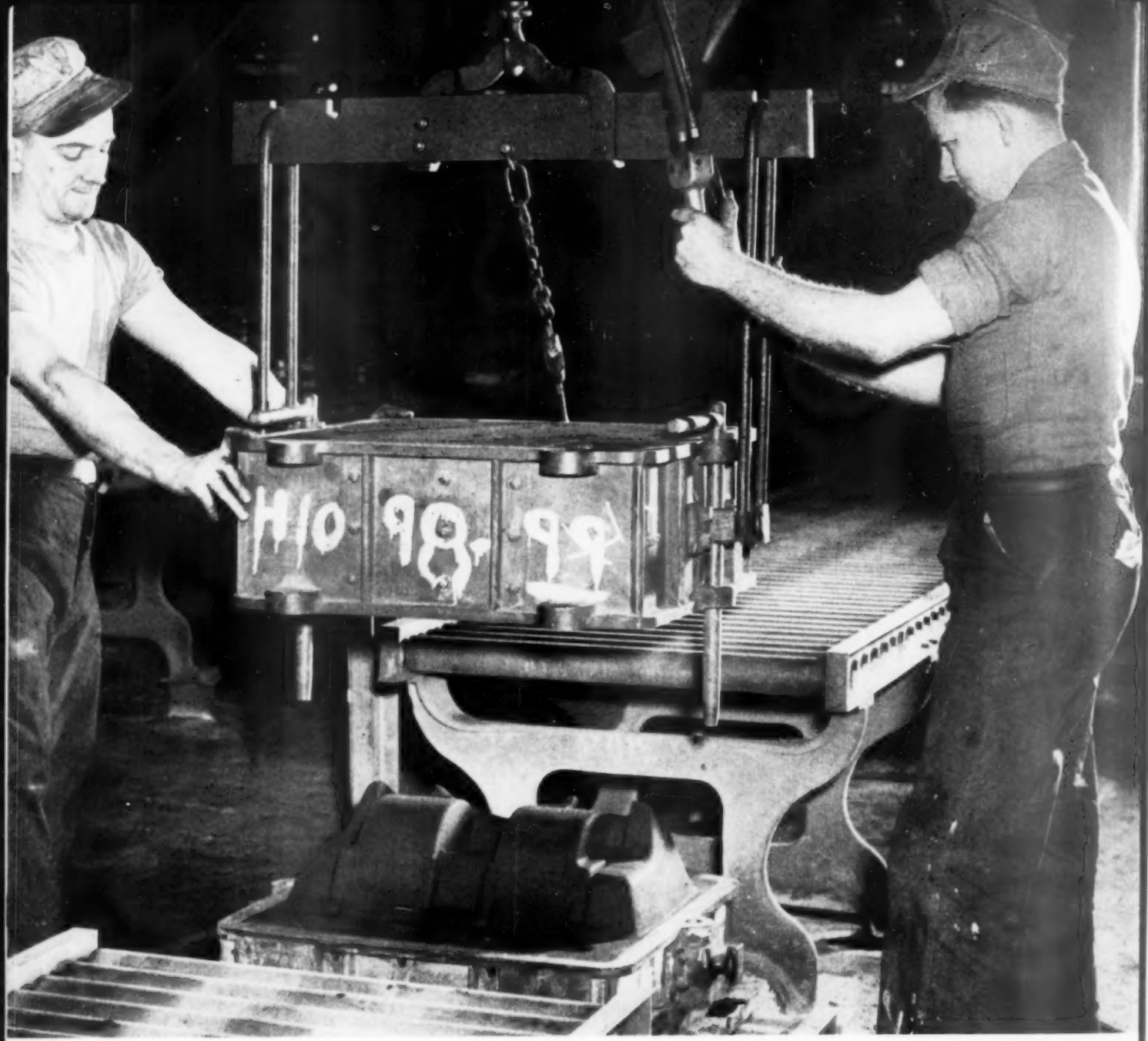
The elongation can easily be increased up to 9 per cent minimum with a draw, or 17 per cent minimum with a short annealing treatment with somewhat lower strength properties. It may also be moderately increased in the as-cast condition with sacrifice of some tensile strength. It is important to note that no premium materials have been used in data covered by this paper, and all data presented in substantiated by certified reports.

With the foregoing as a background and confidence that results could be consistently reproduced, it was deemed time to solicit business and enter production of this new engineering material. By this time, some of the castings made experimentally had been tested and approved by customers. Based on these results, some orders were beginning to specify ductile iron. At present a great many more test castings are in the field for performance and service data. The tonnage has built up gradually, and a portion of the daily production has now been replaced by spheroidal instead of flake graphite iron.

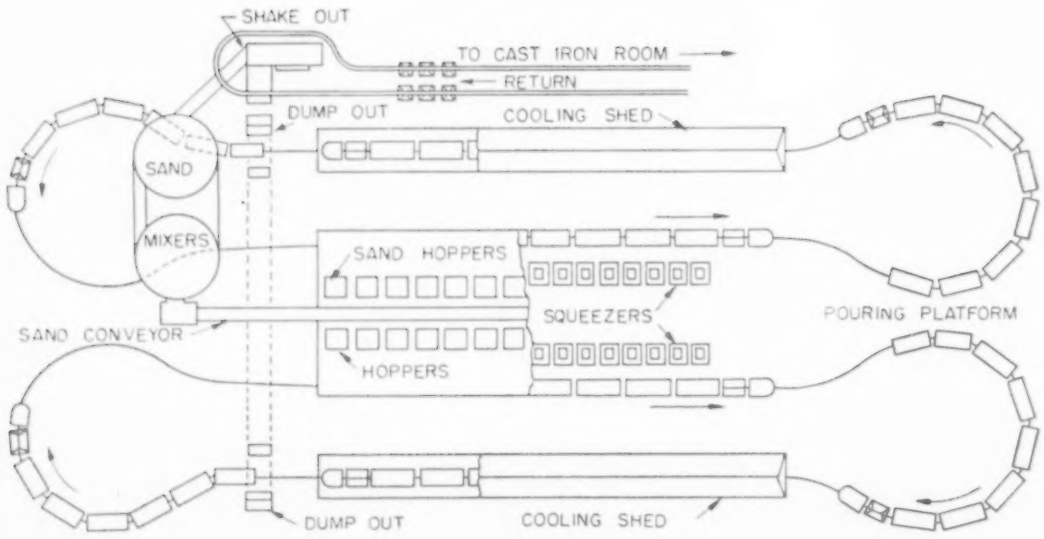
As in the case of new parts, or parts made in a new shop, there are usually some problems relating to gating and risering, etc. In this case there is an added variable because this is a new metal. Some of these problems have arisen, however, it is believed that each job, if troublesome, will require individual consideration until enough experience has been acquired to predict the result of possible gating and risering changes on the large variety of castings handled. This thinking has been applied successfully.

Examples of the type of castings produced are shown in the various accompanying illustrations.

Fig. 4—Examples of various sizes and types of ductile iron castings produced at authors' foundry



Above—Closing a mold at gray iron foundry of Whitin Machine Works, Whitinsville, Mass.



Left—Layout of two mold conveyor loops serving battery of 32 squeezers

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PRODUCING
Textile Machinery
CASTINGS

This is the first of two articles dealing with the history of the Whitin Machine Works, Whitinsville, Mass., and its current practice in producing textile machinery castings. The concluding article will appear next month

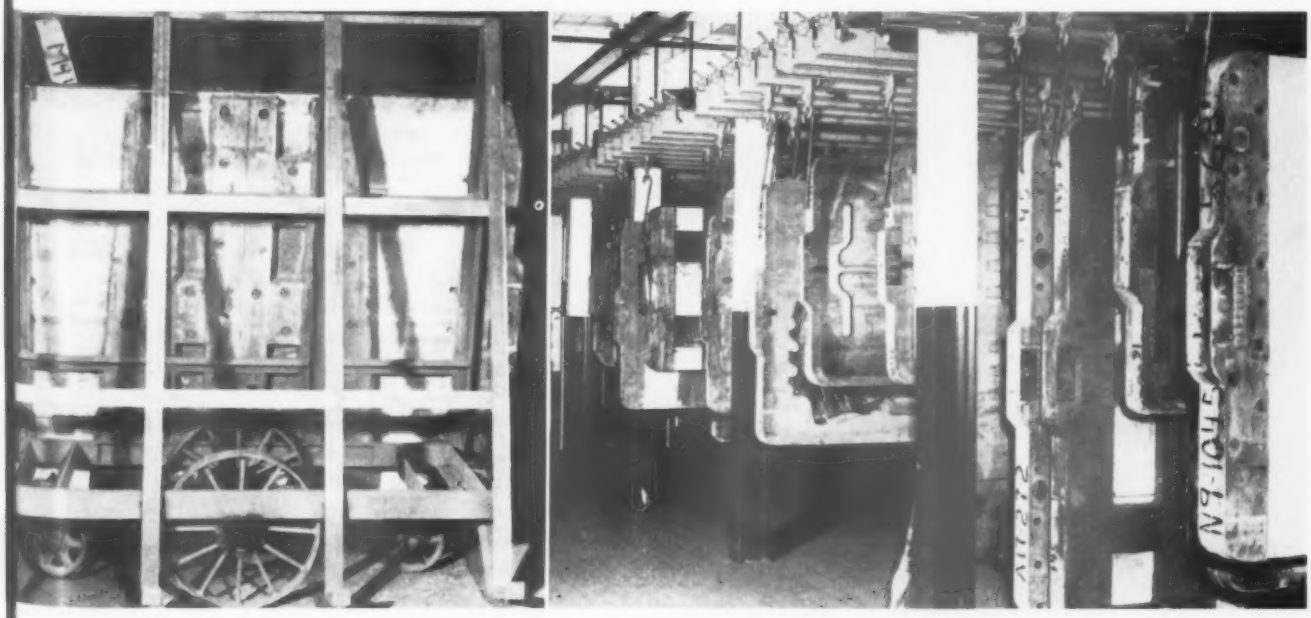
A GENERAL idea of the size and operational scope of the Whitin Machine Works, manufacturer of textile machinery at Whitinsville, Mass., may be inferred from the statement that the gray iron foundry department has a daily melting capacity of 150 tons. Mechanical mold, core and sand handling equipment, also a steady, skilled and dependable personnel, provide the means for absorbing the daily heat.

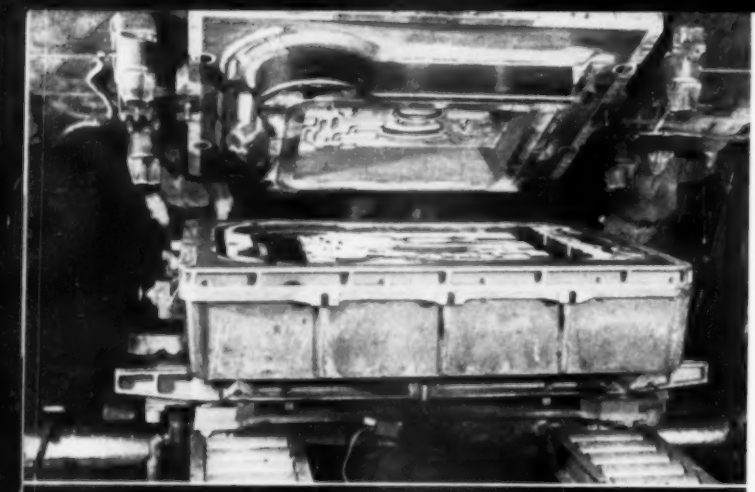
The foundry and remaining group of buildings in the mile-long plant face the village main street and extend back, partly on made land, to the Mumford river. The plant was not built in a day or a week. From a very humble beginning it has been growing steadily and improving its facilities for 120 years. The actual embryo roots extend back even further. As an example of what can be and has been done by sturdy, independent, inventive and far-seeing industrial pioneers a brief reference to the early years may be appropriate. Looming out of the mists of the far distant years, the first individual is a blacksmith. Ancient and modern literature presents many eulogistic references to blacksmiths. Readers of Longfellow's "Evangeline" are familiar with the tribute:

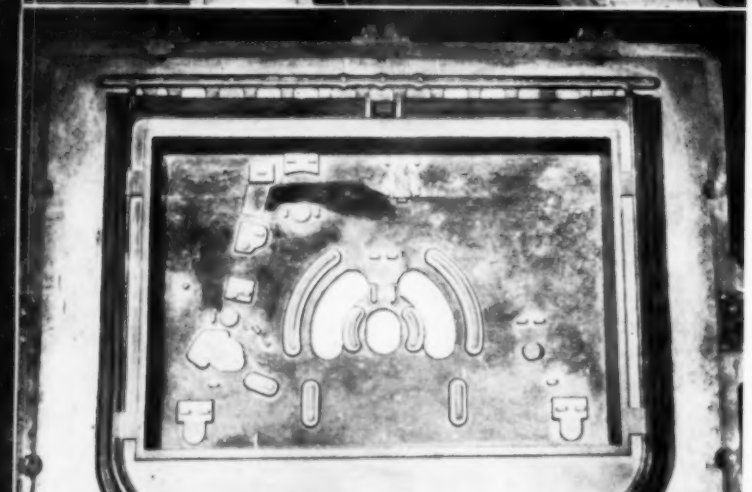
> "Who was a mighty man in the village and honored of all men. For since the birth of time, throughout all ages and nations, has the craft of the smith been held in repute by the people."

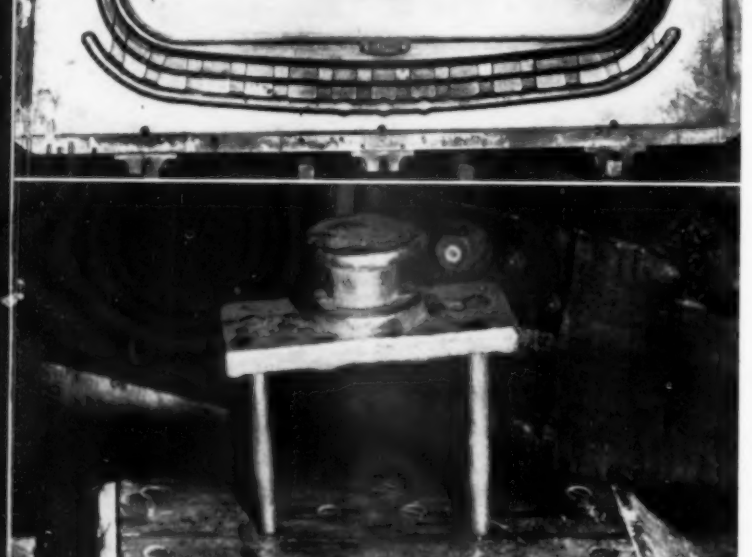
Industrial history of the southern part of Northbridge in central Massachusetts, later to be known as Whitinsville, is traced back to the establishment of a forge or iron works at Mumford Falls in 1727 by Samuel Terry. In 1736 the iron works had three

Large pattern boards waiting transportation to storage are parked on edge on small dollies (below left). Boards in storage are suspended from trolleys on overhead monorail tracks, as shown at right below









Pattern boards used range in size up to 6 x 10 ft. Larger sizes are handled by means of cast iron trunnions (bottom view). When moving a board the trunnions are attached by inserting rods through holes in steel plates attached at opposite ends

fires, one hammer and an ore yard. After passing through many hands the iron works became the property of James Fletcher. About 1790 young Paul Whitin came from Dedham, Mass., and signed on with Fletcher as a blacksmith apprentice.

He soon developed the critical eye and the manual dexterity which entitled him to a place in the ranks of the leather-aproned craftsmen. That he earned the approval and measured up as a man and a mechanic to all the standards set by the master may be inferred from the fact that he married Fletcher's daughter and later became a business partner.

At that period the works produced bar iron. Later the firm made hoes and scythes. During the English embargo, 1807-1809, other farming tools were made. Three hammers and a power-driven grindstone were in constant operation. Nearby Mumford Falls furnished the motive power. Presumably the potential water power was one, if not the main, factor in the selection of a site for the iron works. Many years elapsed before New England manufacturers could hitch the industrial chariot to the miracle-working giant *steam*. Men still living can remember when the elusive and mysterious electric current first was saddled and bridled and hitched to the same old industrial chariot.

Developed Improved Picker

Before leaving the busy knights of the hammer, the tongs and the anvil, it may be permissible to draw some slight comparison between another well known Longfellow character and the enterprising young man who apprenticed himself to the blacksmith trade. The village smith toiled from morn till night under the shade of the spreading chestnut tree. He did not plant the tree and there is no evidence to show that he was responsible to any extent for the growth. Paul Whitin, the skilled young blacksmith, had a son, John C. Whitin, who grew up under the fostering eye and care of his master blacksmith father. John C. dropped some seeds which blossomed and bloomed into the mighty tree known today as the Whitin Machine Works.

History of the Whitin management has been the history of the Whitin family. John C., the founder (1831-1882), was succeeded by a son-in-law, Josiah Lasell. Next came his son-in-law G. Marston Whitin (1886-1920), to be succeeded by son-in-law E. Kent Swift, present chairman of the board of directors. Each succeeding regime has meant the addition of new blood without sacrificing experience and knowledge so essential to an industry as old and as intricate as the manufacture of textile machinery.

Whitin Machine Works was born in 1831 when John C. Whitin, master mechanic in his father's small cotton mill, developed his improved picker. With two lathes and two helpers he completed the improved picker. A patent was granted in 1832. As a result of the picker machine and the genius, energy and business ability of the inventor, the original small iron forge has become one of the largest builders of textile machinery in the world.

Ready acceptance of the improved picker encouraged the inventor to manufacture pickers for mills

TABLE I—Core Sand Mixtures

Small and medium size cores: 50 per cent Marion, 50 per cent Providence River sand; 1215 lb sand, 18 lb oil, 1.5 per cent cereal, 5 to 6 per cent water.
Core blowers: 75 per cent Marion, 25 per cent Providence River sand; 1215 lb sand, 20 lb oil, 1.5 per cent cereal, 3 per cent water.
Large cores: 90 per cent Marion, 10 per cent Providence River sand; 1215 lb sand, 16 lb oil, 1.5 per cent cereal, 6 per cent water.

TABLE II—Molding Sand Characteristics

New Sands as Received	Grain Fineness	Clay	Perm.	Moist.	Green Comp.	
Albany 1½	120-150	13-16				
Albany 2½	70-90	10-13				
Albany 3½	60-80	10-13				
Jersey	60-70	14-16				
Jersey	40-50	14-16				
Providence River	140-170					
Marion	90-110					
Wareham	50-70					
Local silica No. 5	120-140					
Local silica No. 6	170-210					
Heap Sands as Used						
Bench) Squeezer)	120-130	6-7	35-40	3.0-3.5	9.5-10.5	Syn.
Side floors	80-90	8-10	40-50	6-7	8-10	Syn. and Natural
Jolt (light)	80-90	5-6	40-50	4.0-4.5	8-10	Syn.
Jolt (heavy)	65-70	5.5-6.5	55-65	3.5-4.0	10-11	Syn.
Roller rammer	70-80	8-10	50-70	6-7.5	4.5-6.5	Natural
Sandslinger	70-80	11-13	65-75	5.5-6.5	9-11	Natural

which had recognized merits of the device. It was not long before the textile machinery business dwarfed the cotton mill from which it had sprung. The name "Whitin" today is seen on machinery operating in mills everywhere inside the round world's rim where substances are converted into textile material.

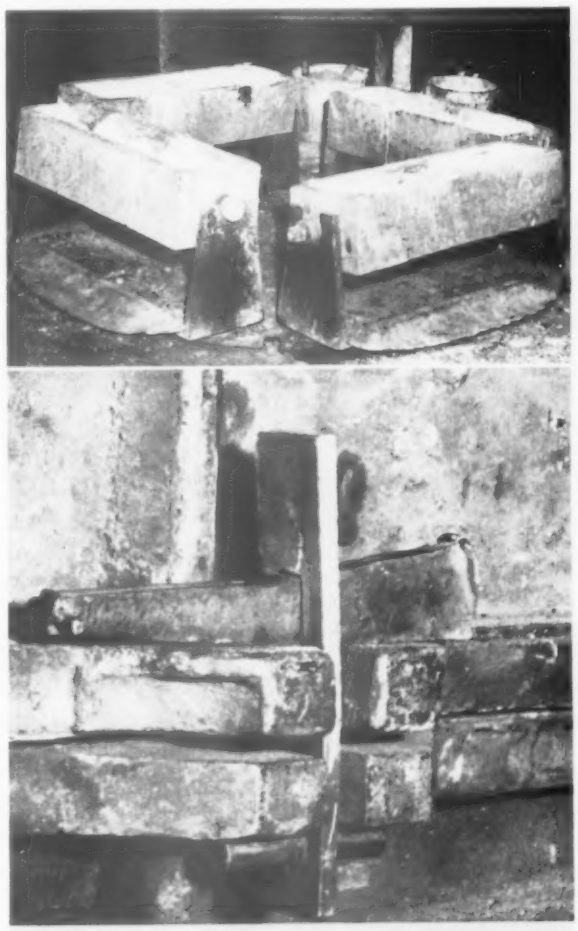
For precision, accuracy and smoothness of operation textile machinery conforms to highly exacting standards. Therefore, it is only natural that the foundry department where the castings are made is maintained and operated according to the high standards prevailing throughout the entire plant. Over the years, changes and improvements in equipment and methods have been introduced in keeping with advancing foundry technique. In recent years improvements include conversion of the formerly hand-operated foundry into a highly mechanized unit, clean, air conditioned, free of dust and smoke, where the burden of human labor has been lifted to a gratifying extent and where machinery is automatic to a remarkable degree.

The floor in the main foundry building, 300 x 500 ft, is divided into 12 longitudinal bays by rows of steel columns. Wide gangways facilitate movement of material by lift truck or by an extensive monorail system which covers the entire foundry floor. Principal activity of the monorail is the distribution of molten metal from the cupolas near one end of the building. Melting is continuous and the iron is distributed to synchronize with mold production on the various units. The floor or conveyor space is utilized several times, instead of only once as is customary in shops where the entire daily production of molds is placed on the floor in the early part of the day and then poured off in the afternoon. A second advantage of the continuous system is that the flask inventory and consequent storage space is reduced considerably.

Greater production and more efficient operation are secured where one crew makes the molds, a second crew pours the metal, and a third crew shakes out the sand and castings and returns the flasks to the molding stations. Obviously a man confined to a single operation rapidly develops greater speed and skill than where he has to become familiar with the entire operating cycle involved in the production of castings.

Existing patterns are rejuvenated and new patterns are constructed in two pattern shops on the second floor, one equipped with the necessary tools and facilities for handling metal patterns, the other equipped in a corresponding manner for processing wood. Some patterns are comparatively plain and simple, while others reflect the highest degree of technical skill and knowledge. This is particularly noticeable in many thin section patterns that extend over a large area.

For use on the various molding machines the patterns are mounted on flat boards of a size to correspond to the size of the flask, and to the lifting capacity of the machine. The pattern boards in sizes up to 6 x 10 ft are constructed from 2-in. lumber matched and joined accurately and fitted with steel wear strips and steel bumper plugs to withstand the jolting action of heavy cast iron flasks. The larger sizes are equipped with an ingenious device by which they may be lifted and transported from place to place. A small cast iron (*Please turn to page* 211)



Top—Pigging molds are trunnion mounted to facilitate dumping. Bottom — Wedge clamp holds cope and drag together

QUESTIONS and A

Metal Burns Into Bushing Core

Q.—We are making a bronze bushing 4¾ in. in diam, 24 in. long with a 1½-in. core, and we are unable to keep the metal from burning the core for about 6 in. up from the bottom. Bushing is poured from the bottom with a riser. Core is oil-sand and blacked or coated with two or three coats of best plumbago for heat resistance. We have poured the metal hot and quite dull, and although the dull metal has the best results, it leaves the bushing a little spongy.

A.—Your difficulty from the bronze penetrating the core or burning-in is due to the amount of metal passing over that section of the core. We believe that you can eliminate the trouble by pouring the bushing on end using a ring of small pop gates at the top, centered between the outside and inside diameters. Length of the pattern should be increased about 3 in. to act as a riser, and as might be expected, you will obtain a much greater yield than the present method of using a long sprue and riser.

If you do not want to change from your present molding procedure in making the bushings, we suggest that you do a little experimenting with the core coating. There are available from a number of suppliers whose names and addresses are listed in the "Where-to-Buy Directory" on page 234 of this issue, a wide variety of core washes, and any of those will be able to supply a material to eliminate your trouble with burning in. Possibly the penetration can be overcome by applying a thick graphite paste which is rubbed on by hand so that all the pores of the core are filled. Core should be dried thoroughly before use.

Mold with Resin-bonded Sand

Q.—We will appreciate any information you can supply on the Croning molding processes which employs resin as a binder in the sand molds. Who controls the patents on the process, and what are the distinct benefits from use of the process?

A.—The Croning or "C" process, as it sometimes is called, was developed in Germany. Essentially the process consists in forming a thin shell-mold from a resin-bonded sand. Clay-free silica sand is used, and its grain size will depend upon the surface finish desired on the casting; generally from 120 to 150, but it may be finer. Resin or bond content of the sand is 5 to 9 per cent, and suitable resins are available from a number of firms.

Mixed sand is placed in a flask on the metal pattern which is heated to about 500° F and allowed to remain for approximately 2 seconds which results in a thin shell of sand about 3/16-in. thick. Pattern and flask are then turned over to remove the excess, unhardened sand which is kept for further use. Pattern containing the shell mold in position is placed in an oven for about 2 minutes at 600° F which polymerizes or hardens the resin-sand mixture so that it can be handled. Shell mold is removed and allowed to cool.

In making a complete mold, two half-shells are joined together, either by clamps or by a sodium silicate paste. Molds are backed up with iron shot, such as used for abrasive blasting, or dry sand before being filled with molten metal. Shell cores for use in molds are made in a similar manner. Numerous advantages are claimed for the process, such as ability to produce thin section, close dimensional tolerances, fine surface finish, freedom from surface flaws, and high production. Crown Casting Associates, 75 Federal St., Boston, claims ownership and control of U. S. and Canadian patent applications.

Making Tablets and Plaques

Q.—We are making tablets and plaques on a small scale and are spraying the molds with silicate of soda, placing the patterns back in the mold, removing them, and then skin drying the mold. Is silicate of soda the best material for the spray, and is the procedure mentioned the best to follow? For the background of the tablets, we use a hot solution of liver of sulphur which is brushed on after careful wire brushing of the casting as we do not have sandblast equipment. We cannot seem to get an even color, and wonder if there is any information on the subject.

A.—As might be expected a variety of methods are employed in the production of tablets and plaques, and any particular one will depend in a large degree on the intricacy of the ornamentation, lettering, etc. involved. Your procedure of spraying the mold face and "stamping back" the pattern is a common one. The spraying operation is to provide additional bond to the sand for the drying operation to follow, and in most cases molasses water is employed. However, if the silicate solution gives satisfactory results, there is no reason why a change should be made. Sometimes the mold face is dusted with flour without use of spraying, and the excess carefully blown out. The practice of stamping back is to provide sharper delineation of letters or other ornamentation as well as a smooth background, but is not necessary if there has been no disturbance of the mold face in separating pattern and mold.

Producing a uniform brown color on copper-base alloys requires skill and experience. Possibly your sulphide solution is somewhat strong, and your method of brushing it on may apply more in one place than another. Again it might be that the surface where the dark areas appear is slightly porous. Best

Answers

procedure we believe, would be to use a more dilute solution of the sulphide, dip the pieces, and allow them to drain. Then scratch brush. Repeat the procedure until the desired color is obtained.

Casting Defect Caused by Gas

Q.—Under separate cover we are forwarding a small piece broken from a locomotive crane steam cylinder 10 in. diam, 18 in. in length, weight 425 lb. The cylinder was cast in a vertical position and was gated through the dry sand barrel core. In the machine shop the first cut in the bore disclosed a worm hole ½-in. deep, 4 in. above the bottom end of the casting. Remainder of the casting, as you may note from the fracture, was perfectly clean and solid. We shall appreciate your opinion on the cause of the defect.

A.—On several occasions this annoying form of defect, one or more worm holes in an otherwise perfect casting, has been traced to a small gas explosion caused by a small clay ball or some other form of foreign material in the core or mold face. The gas jet developed by the small foreign body forces its way into the molten metal in the immediate vicinity. Force and temperature of the jet create a chilling effect, forming a thin protective skin which prevents the surrounding molten metal from filling the cavity.

The obvious remedy is to prepare the core and facing sand with the greatest care to prevent the inclusion of clay balls or other extraneous material. You may be interested to learn that many years ago we were present at the inquest held on a large steam belt casting containing several worm holes on the face not far from the bottom. Following the autopsy, a stricter supervision of the facing material eliminated any further trouble.

Cores for Soil Pipe Castings

Q.—We are contemplating the manufacture of soil pipe and fitting castings on a small scale in a general jobbing foundry equipped with a 20-in. diam cupola melting 1½ tons per hour, good, hot metal. Straight lengths, single and double bell, are 4 in. diam and 5 ft in length. We shall appreciate information on the subject, particularly on the cores and core arbors for green sand.

A.—In the regular soil pipe making plants, the arbors for the straight pipes are stiff cast iron pipes allowing approximately ½ in. for sand. Some foundrymen favor the use of steel tubes. The cast iron arbors are machined at both ends so that they may be revolved in suitable bearings while the sand is applied, and later so that they fit snugly in the cut-out flask ends. While the arbor is revolving, sand falls in a thin stream from an agitated overhead hopper with the long, thin opening about 5 ft above the arbor. For limited production the sand might be pressed on the arbor by hand. The arbor is revolved mechanically by clutch arrangement, or by a plug and crank handle operated by hand. The sand gradually adheres to the arbor and is cut to the proper shape and size by a horizontal sweep resting on suitable supports. The arbor is provided with a row of small vent holes on the top. A small knob or other suitable mark on one end of the arbor guides the men in setting the core so that the vent holes are on the top. Sand varies to some extent in different parts of the country. With a comparatively close, or tight sand it is necessary to have vent holes in the bottom and sides of the arbor.

For limited production another type of arbor might be employed. This type may be used in the as cast condition. It is not machined at the ends. It is merely a stiff central member with semicircular wings at right angles and spaced about 4 in. apart. The wings occupy only the drag half of the core, but the back bone extends about an inch into the cope half to insure stiffness and prevent the core from springing in the center and thus cutting off thickness in the cope part of the casting. A corebox is required with this arbor. The corebox may be hinged or made in two separate halves. A ½-in. thickness of sand is placed in the bottom of the drag half box. The arbor is placed in position and sand is rammed between the wings up to the joint line. A ¼-in. rod is laid alongside each side of the central back bone rib to form vent openings. The second half of the corebox is filled with sand pressed down with the hands and struck off level. The two halves are booked which means they are brought forward face to face in a vertical

GANGWAY!

By J. A. PATTERSON

"Why don't you speak up—how do you want your eggs, up or over?"

position and afterward lowered back on the floor or bench with the drag part underneath. The top half corebox is lifted off or swung back on the hinges. The core is lifted out and placed in the mold.

In a third method sometimes employed for soil pipe and other types of pipe castings, the same type of arbor is employed, but only one half corebox is needed. A short section over the top at one or both ends, forms the bell. The half corebox is filled with sand as in the preceding instance. The top end piece is attached to one or both ends and sand is pushed through the openings. Remainder of the core is built up slightly over size with the hands. A semicircular strike riding on both sides of the corebox is pulled from end to end to impart the desired shape to the top half of the core. In all cases the arbor is enlarged at one end. Where the arbor is needed for a double bell pipe, a loose ring is slipped over the opposite end and tightened with a small wood wedge.

Articles on soil pipe foundries, methods and equipment have been presented in THE FOUNDRY on many occasions. An interesting description of a large plant where the molds are made two at a time on a jolt machine, and the cores are made on steel tube arbors appeared in the June and July, 1946 issues. Production of soil pipe castings is a highly specialized branch of the foundry industry.

Sand Condition Is Not Uniform

Q.—We are sending you two gray iron castings which are giving us considerable trouble. They were poured from iron containing 3.02 per cent Si, 0.91 per cent Mn, 0.43 per cent P, 0.066 per cent S, and 3.35 per cent TC. They are made in No. 125 Millville sand with 16 AFS clay content. Heaps are mulled once a week since we are not able to do it each day, and new sand additions are made to the heaps without mulling. We have made these castings for years under the outlined conditions, but in the past few months have run into trouble with small pinholes as marked on the castings. We believe the condition to result from blow-offs from clay balls, but why, if this is so, should it show up only in the past few months? The castings must be gas tight.

A.—While it is possible that the holes appearing on your castings may be the result of little spirts or jets of steam generated by molten metal striking clay balls or small lumps of sand, we believe that essentially it is due to sand grains being washed from one part of the mold to another where it becomes imbedded in the surface. Examination of the under-surfaces of the castings shows numerous places where washing, erosion or cutting has occurred, but of course, some of that may have been due to broken edges which were not patched before closing the mold.

Since the castings submitted were cleaned carefully, it was difficult to ascertain the cause of the small holes. However, careful study of their interiors revealed the presence of sand grains in some, and hence the opinion that displaced sand is the culprit. As to why the trouble only recently appeared is a matter of conjecture. While you say that no changes have been made in practice, there is a good possibility that some have been made—not radical, but gradually over a period of time. It may be that your sand is on the low side in clay content, and an insufficient amount of new sand is added—or it may be that the new sand is not as high in clay content as it is supposed to be, and more should be added.

Possibly the new sand is not distributed uniformly over the heaps resulting in some parts being slightly weak and other slightly strong. New sand additions to be of any value should be mixed in thoroughly, and possibly the sand is not being cut over sufficiently to accomplish that purpose. It might be worthwhile to check on the trouble, and note whether it appears at all times or whether the latter part of the week after the heaps are mulled. Also it will be of value to have some tests made of green compression strength, permeability, clay content, and moisture at various periods during the week, and then make the necessary adjustments which will provide uniformity of sand conditions.

Wants Data on Cores for Brass

Q.—Although our demand for cores is not very great, we would appreciate receiving any information relative to the use of baked cores in the yellow brass foundry.

A.—Use of baked cores in yellow brass foundries is quite common. A variety of core binders are used and include, in addition to core oil, resin, cereal, lignin or sulphite, glue or casein, etc. Core oils usually are employed with clean, clay-free sand in the ratio of 1:40 to 100 by volume depending upon the strength and rigidity desired in the core. Resin binders generally are used with cereal binders or with some molding sand in the core mix. Usual ratio by volume of cereal and resin is 1:2 with 60 parts of sand. Resin alone may be used with 30 to 50 per cent molding sand in the mix, and 1 part binder to 20 parts sand.

These figures are general, and the proper combination will have to be determined by experiment in your foundry. Manufacturers and suppliers of various types of core binders will be glad to supply information on their products. Names and addresses may be found in the "Where-to-Buy Directory" on page 234 of this issue.

Grain Structure Not Uniform

Q.—We are producing stainless steel castings containing 12 to 14 per cent Cr and 1 per cent Mo, but have difficulty in obtaining a uniform fine-grain structure. We will appreciate your advice on whether there are special measures to be taken in melting or annealing this material.

A.—High-chromium-content steels have a strong tendency to form large crystals on solidifying from high temperature, and the 12 to 14 per cent Cr grade is no exception. To keep the grain size as small as possible it is advisable to pour the steel into the molds at the lowest temperature at which it will fill out all the detals of the casting.

(*Concluded on page* 92)

Shakes-Out

Conveys

Magnetically Separates

Tempers and Conditions the Sand

A Complete SHAKE-OUT and SAND CONDITIONING UNIT

The Royer Shake-Out and Sand Conditioner is a compact, complete unit that practically eliminates the manual labor of the sand conditioning crew. As rapidly as the shake-out crew can feed the flasks, it shakes out the mold, deposits castings and scrap in tote boxes or other receptacles, conveys the sand over a magnetic separator which removes any remaining fine scrap, tempers the sand as it enters the hopper of the Sand Separator and Blender and discharges it thoroughly conditioned and ready for the molders' use.

The Royer Shake-Out, designed for light to medium work, offers the advantages of fast, positive operation, with low maintenance cost and long life due to its vibrationless operation.

The complete Shake-Out and Sand Conditioning Unit can be furnished with or without magnetic separator and in stationary or portable types. Write for complete information — we will gladly offer suggestions that will be of value to you.

ROYER

FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.

159 PRINGLE ST., KINGSTON, PA.

QUESTIONS and Answers

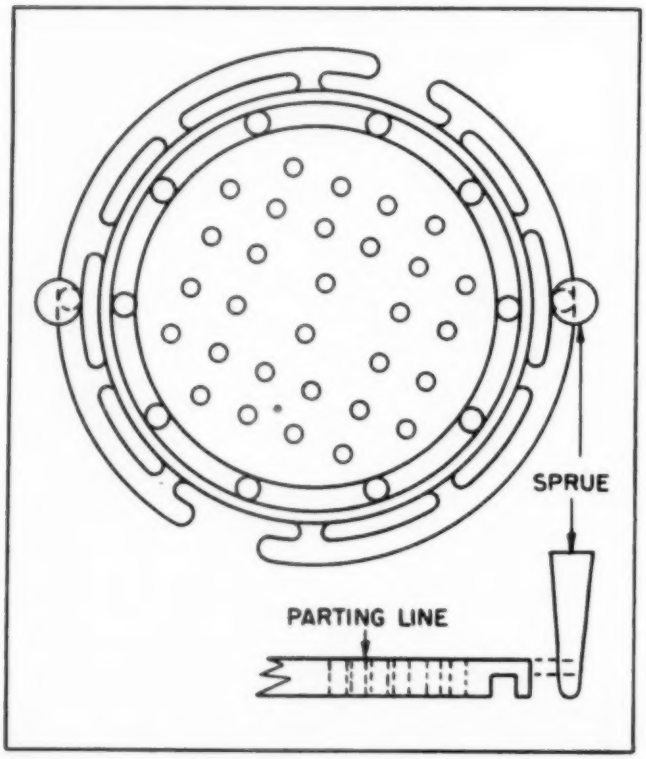
(*Concluded from page 90*)

Heat treatment consists of heating the castings to approximately 1850° F for an hour or more, cooling in air, and finally drawing at a temperature of 450 to 700° F for 1 to 3 hr. As the compositions of your castings, aside from the Cr and Mo content, are not stated, nor is any information given as to the melting method, it is difficult to judge why you are having trouble in obtaining uniform fine-grain structure. Perhaps it may be due to insufficient residual aluminum in the steel if you are employing it as a deoxidizer. Some time ago, J. B. Caine, in discussing grain size control, stated that silicate inclusions mean coarse-grain steel; mixed inclusions, mixed grain size, and alumina inclusions mean fine-grain steel.

Should Change Gating Method

Q.—We are enclosing a sketch of a bronze casting with which we are having trouble. It is made in the 85-5-5-5 alloy and is 12 in. in diam. Center portion is ⅞-in. thick and is joined to the rim with a section ⅜-in. thick. We find leakage in the majority of the castings where the heavy center section joins the thin section opposite the gates. We use a single ¾-in. sprue which feeds a semicircular ½-in. runner entering the cavity at two points about 6 in. apart. Two 2-in. risers about the same distance apart are on the opposite side. Casting is molded and poured flat at about 2200°F.

A.—Difficulty with leakage in your circular casting is due to lack of feed. The metal has to travel across the area, and becomes cooled. The rim and thin section freeze quickly and in that process draw metal from the adjoining center section. However, additional metal fluid enough to feed the latter is not forthcoming, so shrinkage voids are present.



Employment of a multiple gating system and pouring simultaneously from two points will give uniform distribution

One method of obtaining sound circular plate castings is to employ a ring of small pop gates around the top, but in your case the numerous holes seem to preclude that procedure—especially if the pattern leaves its own green sand cores. The only other suggestion is to employ two semicircular runners poured from two ladles on opposite sides of the mold, and a number of branch gates from the runners to the cavity.

While this appears to be an extravagant use of metal, it is the only way to supply metal uniformly to the cavity. In connection with the gating system shown, your attention is directed to the extensions at the ends of the runners to catch any dirt and also to dissipate the first surge of metal. Similarly the sumps at the bottoms of the sprues cushion the fall of the metal and eliminate turbulence.

Consider Slagging From Front

Q.—In our general jobbing gray iron foundry we make castings from 10 to 6000 lb. In certain castings, for example mine locomotive wheel centers weighing about 300 lb, we find slaggy streaks or patches after the tread has been machined. The ladle is supposed to be skimmed, but some times when the surface is crusted over, the man skimming the ladle may be somewhat careless. Do you know of any hard and fast rule that will insure the production of perfectly clean castings? Would you suggest a forehearth or a bridge gate in the cupola spout to deflect the slag to one side?

A.—Front slagging spouts are employed in numerous gray iron foundries, but their successful operation depends on running a continuous stream from the tap hole. We do not think the idea is practical in a general jobbing foundry like yours where you make castings from 10 to 6000 lb, and where presumably the heat runs 1, 2 or 3 hours in the afternoon, and where the tap hole is opened and closed intermittently throughout the heat.

The subject of front slagging through the spout was discussed to a considerable extent in the November, 1936 issue of THE FOUNDRY and information on construction is given on pages 44-47 of the *Handbook of Cupola Operation*. With the majority of cupolas running long heats, the slag is drawn off readily through a slag hole at the back. Whether the heat is long or short the tap hole should be stopped at or just before the first slag appears. Where this is done you will have no slag to contend with in the ladle. However, if slag does accumulate on top of the metal in the ladle, it can be frozen in place with a dash of water and then easily may be held back with a skimmer. It may not be out of place to suggest that a slaggy area on a casting may not be caused by slag in the metal. In many instances that species of defect is caused by loose sand washed in by the stream of metal from the runner basin, sprue or gate. Hence, it might be well to consider that point.

It stops profit leaks in the cleaning room

LIKE A CHAIN that is no stronger than its weakest link, a foundry can not attain peak efficiency—and earning power—with jumbled piles of castings strewed around the cleaning room.

In most foundries the time and the cost of handling castings from the shakeout through the cleaning room can be—and should be reduced.

Apron Conveyors of proper design, and properly used, permit cleaning room and inspection operations to be synchronized with the tonnage passing over shakeouts—eliminate re-handling—and produce an orderly "flow" of castings similar to the controlled flow of sand through a sand conditioning plant—or to the control of molding, pouring, cooling and shaking out made possible with a run-around mold conveyor.

Slow speed Apron Conveyors, with or without hoods, provide one of the few generally approved methods of cooling castings from shakeout temperatures of around 1500°F., to the temperatures required for mill cleaning or hand sorting.

Apron Conveyors with heavy duty flat tops and no sides, that permit the easy loading and unloading of castings, make ideal chipping conveyors.

Let the Bartlett-Snow engineers, with their wide familiarity with the needs of practical day to day foundry operation, work with you in making your cleaning room as efficient and smooth running as other parts of your foundry. The C. O. Bartlett & Snow Company, Cleveland 5, Ohio. Engineering representatives in New York, Baltimore, Detroit, Chicago.

BARTLETT-SNOW
CLEVELAND 5, OHIO

DESIGNING AND CONTRACTING ENGINEERS

For the Foundry Industry

SAND, MOLD AND CASTINGS HANDLING EQUIPMENT

MEN of Industry

GEORGE W. ANSELMAN, for the past year and a half foundry superintendent, Woodruff & Edwards Inc., Elgin, Ill., has been appointed foundry and sales engineer, Beloit Foundry Co., Beloit, Wis. Mr. Anselman, following training at Lewis Institute, Chicago, served an apprenticeship at Western Electric Co., Chicago. From 1943 to 1948 he was service engineer, Goebig Mineral Supply Co., Chicago, and prior to that was service engineer and superintendent of the Tennessee mill of Ayers Mineral Co., Zanesville, O.

♦ ♦ ♦

Kenneth F. Ode, until recently manager of the Findlay, O., division, Gar Wood Industries Inc., Wayne, Mich., has been appointed manager of operations, Continental Foundry & Machine Co., East Chicago, Ind., with headquarters in Pittsburgh. A graduate of Marquette University, Mr. Ode was formerly associated with the Trackson Co., Milwaukee, and spent 14 years with Falk Corp., Milwaukee, where he was plant engineer and weld shop superintendent. During the war he was a management representative on the Management-Labor Policy Committee, Office of Production Management.

♦ ♦ ♦

M. N. Tallman, who has been elected chairman of the Ontario Chapter of the AFS for 1950-51, is plant manager, A. H. Tallman Bronze Co., Hamilton, Canada, producer of brass, bronze, aluminum and special alloy castings and babbitt metal. Mr. Tallman has been associated with the company since 1940, following graduation from Queen's University, Kingston, Ont., as a metallurgical engineer. He served as vice chairman of the Ontario Chapter last year.

♦ ♦ ♦

George P. Antonic has been appointed superintendent of the West Allis, Wis., plant, Motor Castings Co., Milwaukee. Mr. Antonic was graduated from University of Chicago and served as metallurgist with Motor Castings Co. until 6 years ago when he engaged in research and development in ferrous foundry production and engineering. Recently he has been associated with Walter Gerlinger Inc., Milwaukee, foundry supply company.

♦ ♦ ♦

A. E. St. John has resigned from Federated Metals Division, American Smelting & Refining Co., effective June 1. Mr. St. John was associated with the Federated Metals Division for the past 25 years and during the last few years acted as advertising manager. He has written many technical booklets prepared for users of nonferrous metals.

♦ ♦ ♦

Robert T. Wood has been named chief metallurgist of magnesium products, Aluminum Co. of America, Pittsburgh. Mr. Wood, following graduation from Lehigh University in 1922, joined American Magnesium Corp., Niagara Falls, N. Y., an Alcoa subsidiary. In 1940 he became chief metallurgist for American Magnesium Corp. in Cleveland.

♦ ♦ ♦

Hamilton Merrill has been appointed vice president in charge of the Consolidated-Ashcroft-Hancock Division, Manning, Maxwell & Moore Inc., New York. Mr. Merrill, who was graduated from Massachusetts Institute of Technology, has been associated with Manning, Maxwell & Moore for 30 years, a vice president since 1937 and a director for the past year.

♦ ♦ ♦

Sylvester E. Mueller has been elected vice president in charge of operations and engineering, Boston Electro Steel Casting Inc., Boston. Mr. Mueller, a graduate of Marquette University, received his master's degree from University of Wisconsin. He was formerly associated with the Wheeling, W. Va., plant of Continental Foundry & Machine Co., East Chicago, Ind., and Falk Corp., Milwaukee. He is a past director of the Wisconsin Chapter of the AFS, and served as chairman of Division No. 5 Technical and Operating Committee, Steel Founders' Society of America.

♦ ♦ ♦

Walter E. Jominy, staff engineer, Chrysler Corp., Detroit, will serve as president of the American Society for Metals for the year 1950-51. **Dr. John Chipman,** head, Department of

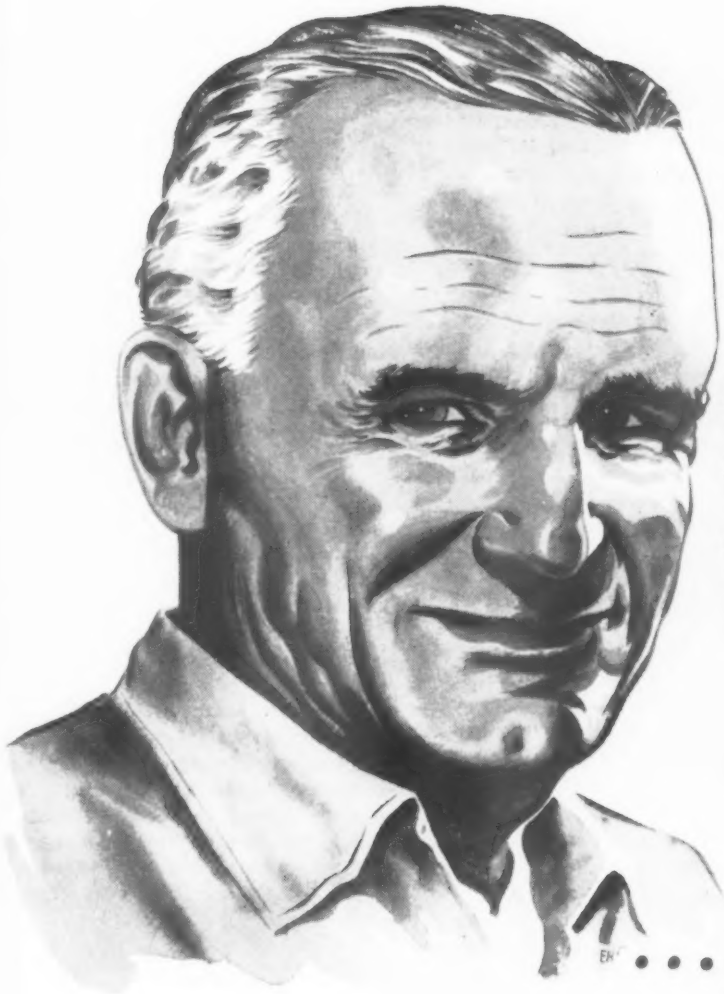
(*Continued on page* 96)

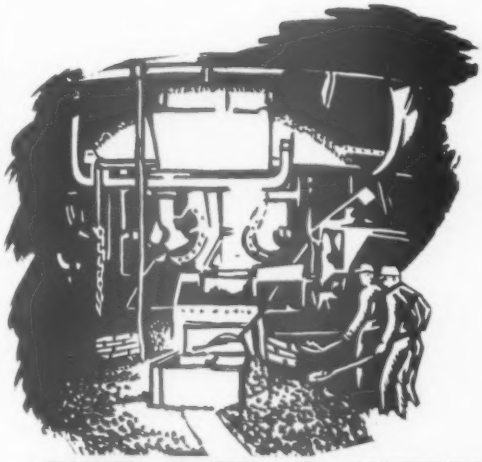
GEORGE W. ANSELMAN

KENNETH F. ODE

M. N. TALLMAN

GEORGE P. ANTONIC





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MEN of Industry

(*Continued from page* 94)

Metallurgy, Massachusetts Institute of Technology, will succeed Mr. Jominy as vice president of the society. **Ralph L. Wilson,** chief metallurgist, Timken Steel & Tube Co., Canton, will serve a second year as treasurer. **J. B. Austin,** director of research laboratories, U. S. Steel Corp., Kearny, N. J., and **Dr. James T. MacKenzie,** chief metallurgist, American Cast Iron Pipe Co., Birmingham, have been named new trustees.

♦ ♦ ♦

A. S. Johnson has been named general manager of the National Carbon Division, Union Carbide & Carbon Corp., New York. Mr. Johnson joined the Edgewater plant of the company in Cleveland in 1928. He went to China in 1933 to assist in plant operations there, returning to the United States in 1939 as assistant superintendent of the Fostoria, O., plant. Three years later he became superintendent of the Clarksburg, W. Va., plant, Cleveland district manager later in that year, and in 1944 was appointed assistant to the vice president in charge of production with headquarters in Cleveland. In 1945 he was transferred to New York to the foreign department, and in 1948 was made a vice president.

♦ ♦ ♦

John W. Lohnes has been named vice president in charge of carbon and graphite sales for Speer Carbon Co., and its subsidiary, International Graphite & Electrode Corp., both of St. Mary's, Pa. For the past 3 years Mr. Lohnes has been general sales manager for International-Graphite. Prior to that he was associated with Vanadium Corp. of America, New York, and Carnegie-Illinois Steel Corp., Pittsburgh. **William E. Harvey,** formerly plant manager of the International Graphite plant at Niagara Falls, N. Y., has been appointed manager of all carbon and graphite plants of Speer Carbon Co. and its subsidiaries. **Robert E. Rice,** formerly assistant sales manager, Speer Carbon Co., has been appointed sales manager, International Graphite & Electrode Corp.

♦ ♦ ♦

Walter W. Trout, president, Lufkin Foundry & Machine Co., Lufkin, Tex., has been elected to the executive committee, American Gear Manufacturers Association, to serve for 3 years. Mr. Trout is a graduate of Purdue University and attended Rice Institute and University of Texas. He joined the company as a machinist in 1925, and served as a district manager, sales manager, vice president and general manager prior to becoming president in 1948.

♦ ♦ ♦

Morris L. Hawkins, recently elected chairman of the Birmingham District Chapter of the AFS for 1950-51, is superintendent of foundries, Stockham Valves & Fittings, Birmingham. Mr. Hawkins joined the company in 1925 and, following an apprenticeship as a coremaker and molder, he became section foreman in the malleable foundry where he was superintendent from 1941-43. Since 1943 he has been superintendent of the malleable, gray iron and bronze foundries. He served as vice chairman of the Birmingham Chapter last year. Mr. Hawkins is also a former president of the Birmingham Chapter of the National Association of Foremen and a former national director of that society.

♦ ♦ ♦

Howard P. Semler has resigned as vice president and assistant treasurer, Semler Co., Jeannette, Pa. Mr. Semler was president-general manager of the company from 1923 until it was recently acquired by the Kennedy Valve Mfg. Co., Elmira, N. Y.

♦ ♦ ♦

L. D. Harkrider, president, General Malleable Corp., Waukesha, Wis., has completed his second term as president of the Wisconsin Manufacturers' Association. Mr. Harkrider, as leader of the manufacturers, has centered his efforts on making people more acquainted with what industry is doing. He was member of the 1948 Wisconsin trade mission which toured eight European countries in the interests of American industry.

♦ ♦ ♦

Harold S. Austin, since 1935 foundry metallurgist, Buick Motor Division, General Motors Corp., Flint, Mich., has retired. Mr. Austin was graduated from Rose Polytechnic Institute in 1907, later receiving an advanced degree in chemical engineering there. Following several years spent in the coke and steel foundry industries and at Underwriters Laboratories, Chicago, he joined Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., as chief chemist and metallurgist, where he remained for 17 years.

♦ ♦ ♦

Dr. Kent R. Van Horn, assistant director of research, Aluminum Co. of America, Pittsburgh, in charge of the company's branch laboratories in Cleveland, will become associate director of research for the company, effective Aug. 1, with headquarters at the New Kensington, Pa., laboratory. A graduate of Case Institute of Technology, Dr. Van Horn received his doctor's degree of metallurgy at Yale University. He joined Alcoa in 1929 as research metallur-

(*Concluded on page* 98)

A. S. JOHNSON

JOHN W. LOHNES

WALTER W. TROUT

MORRIS L. HAWKINS

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*U. S. Patent No. 2184926 (other patents pending)

MEN of Industry

(*Concluded from page* 96)

gist and since that time has written numerous technical articles and textbooks.

♦ ♦ ♦

John E. Wilson, recently elected president of the Southern California Chapter of the AFS for the year 1950-51, is in charge of the Pacific Coast office, Climax Molybdenum Co., New York. Mr. Wilson was graduated from Detroit City College, now Wayne University, and obtained his master's degree at Michigan State College. He was associated with Great Lakes Steel Corp., Detroit, until 1934, when he joined the Detroit office of Climax Molybdenum Co. He was transferred to Los Angeles two years later. Mr. Wilson served as vice chairman of the Southern California Chapter last year.

♦ ♦ ♦

James H. Rickey Jr. has been appointed sales manager, the Ironton Fire Brick Co., Ironton, O. Mr. Rickey, who was graduated from Ohio State University in 1942 with a degree in ceramic engineering, served 3½ years in the Army. He has been in the production department of the Ironton Fire Brick Co. the last 3 years. A member of the American Foundrymen's Society, he has spoken on refractory materials before various chapters.

♦ ♦ ♦

R. P. Eninger has been appointed manager of the air compressor division, Wayne Pump Co., Fort Wayne, Ind. Mr. Eninger entered the laboratory of the company in 1930 and was engaged in product testing and design until 12 years ago when he was transferred to the sales department. He became manager of foreign sales in 1945 and for the past 2 years has served as domestic sales manager.

RONALD WEBSTER

Since 1941, consultant, Hydro-Blast Corp., Chicago, when ill health forced retirement as vice president-general manager, who recently was appointed sales manager of the company, as reported in THE FOUNDRY, May, p. 158

♦ ♦ ♦

William G. Ferrell, recently elected chairman of the Michiana Chapter of the AFS, is general works superintendent of operations, Auto Specialties Mfg. Co., St. Joseph, Mich., which also operates plants in Benton Harbor, Mich., and Windsor, Ont. Mr. Ferrell was educated in Joliet, Ill., schools and started his foundry career there with William E. Pratt Mfg. Co., a malleable foundry. He joined the Auto Specialties Mfg. Co. in 1918 where he was superintendent of foundries until he became superintendent in charge of operations in 1946. Mr. Ferrell served as vice chairman of the Michiana Chapter last year.

♦ ♦ ♦

Gordon R. Anderson has been appointed general manager of the Freeport, Ill., works, Fairbanks, Morse & Co., succeeding **Lee Madden,** who has retired. Mr. Anderson was graduated from University of Michigan with a degree in electrical engineering and joined the Indianapolis electric works of the company in 1922. He was transferred to the Beloit, Wis., works in 1929, was appointed chief electrical engineer in 1932 and manager of engineering in 1946.

♦ ♦ ♦

G. Caspar Haas, until recently associated with the Wilhelm Engineering Co., Webster City, Iowa, has been named head of the permanent mold department, Fairfield Metal Products Inc., Fairfield, Iowa, manufacturer of aluminum sand and permanent mold castings.

♦ ♦ ♦

H. B. Scott has been appointed southern Indiana representative, Michiana Products Corp., Michigan City, Ind., with headquarters in Indianapolis. Mr. Scott was formerly metallurgical engineer, the Calorizing Co., Pittsburgh. The Philadelphia area has been assigned to **L. S. Johnson,** formerly superintendent of the Midvale Co. there. **A. J. Popovich,** until recently metallurgical engineer, Allis-Chalmers Mfg. Co., Milwaukee, has been put in charge of the northern Indiana territory with headquarters at the Michigan City plant.

♦ ♦ ♦

J. S. Robbins has been named sales engineer, Vulcan Mold & Iron Co., Latrobe, Pa. A graduate of Mount Union College, Alliance, O., he spent the last 15 years in the melting department, Republic Steel Corp., Canton, O.

♦ ♦ ♦

Richard E. McClaine, Buckeye Steel Castings Co., Columbus, O., has been elected president of the Foremen's Club of Columbus Inc.

JOHN E. WILSON

JAMES H. RICKEY JR.

R. P. ENINGER

WILLIAM G. FERRELL

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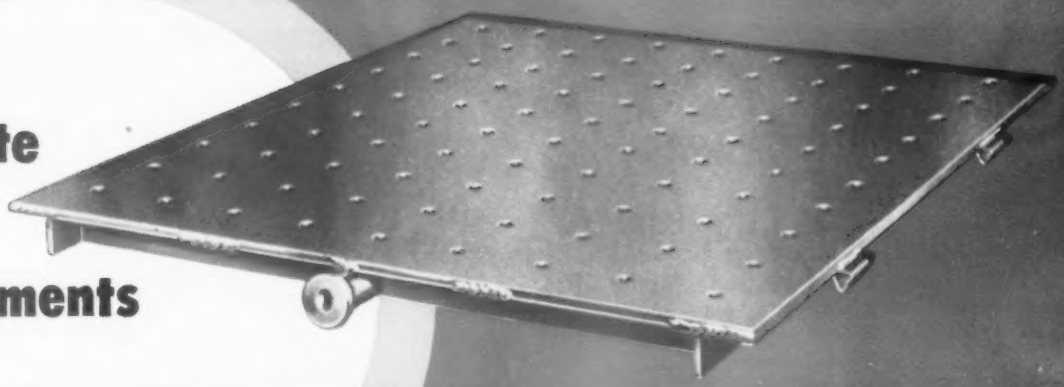
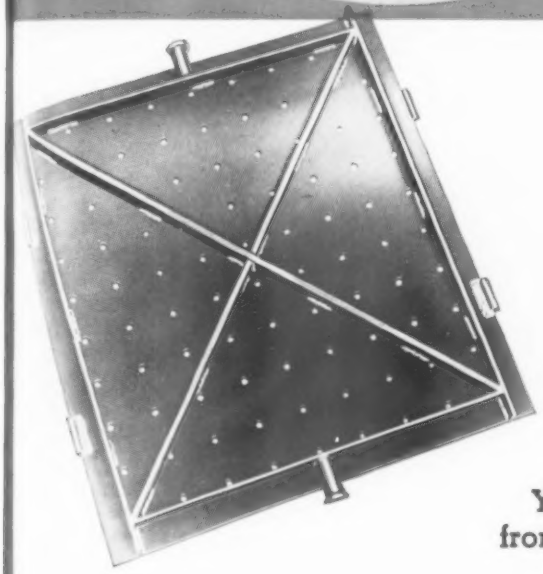


BS&B STEEL BOTTOM BOARDS and CORE PLATES



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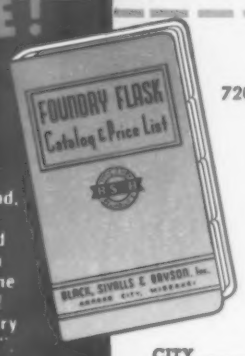

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Industry BRIEFS

J B. Beaird Co.'s 59th St. foundry, Shreveport, La., closed since September, will resume operations again soon under new name and ownership. New owner is the Mid-Continent Steel Casting Corp. whose parent company is Keokuk Steel Casting Corp., Commercial & "M" Streets, Keokuk, Iowa.

* * *

Manufacturing activities of American Magnesium Corp., magnesium fabricating subsidiary of Aluminum Co. of America, since June 1 have been assumed by Alcoa. American Magnesium operations have been conducted at Cleveland and Buffalo and are continued there under Alcoa management.

* * *

Sonith Industries Inc., 50 Shelby St., Indianapolis, iron and brass foundry, has been sold to Peerless Pump Division, Food Machinery & Chemical Corp., 301 West Ave. 26, Los Angeles 31, according to I. W. Smith, former owner.

* * *

Acme Foundry Co. and its associate organization, Acme Tank & Steel Works, 182 Wall St., Saskatoon, Saskatchewan, Canada, have adopted the name Acme Iron Works Ltd. Company reports a new and modernly equipped foundry and machine shop with welding, machining and structural steel work facilities as added services.

* * *

Lone Star Steel Co.'s $1,500,000 cast iron pressure pipe foundry at Longview, Tex., is about 40 per cent completed, according to E. B. Germany, company president. Production is expected to begin in the third quarter.

* * *

Frigilatem Welding Alloys Inc., 1516 Corlies Ave., Neptune, N. J., has been formed by A. E. Zeisel, president, to develop and merchandise low temperature welding rods and fluxes, both gas and arc, for all metals.

* * *

Col. William P. Cornelius has been appointed manager of the new district office of Giffels & Vallet Inc. and L. Rossetti, Associated Engineers & Architects, Detroit. New office is at 2121 Commerce Bldg., Houston, Tex.

* * *

Acme Resin Corp., 1401 Circle Ave., Forest Park, Ill., has appointed Schuler Equipment Co., Birmingham, representative for its resin core binders. In December, 1949, Acme purchased the Interlake Chemical Corp., Forest Park, and is offering that company's resin core binder under the Acme label.

* * *

Ampco Metal Inc., 1745 South 38th St., Milwaukee 15, has appointed Jaeger Welding Supply Inc., Springfield, Mass., and Texas Welding Supply Co., Dallas, Tex., distributors for Ampco electrodes.

* * *

Washburn Foundry Co., Washburn, Wis., has been incorporated by George L. Malinoski, John Malinoski and James B. Hibben to operate a general foundry and machine shop business.

* * *

Burndy Engineering Co., 185 Bruckner Blvd., New York 54, on the occasion of its 25th anniversary this year, is opening a portion of its facilities to jobbing work on nonferrous castings.

* * *

Lapeer Mfg. Co., Lapeer, Mich., has appointed Higginson Engineering Sales, P. O. Box 23, Hamilton, Ontario, Canadian distributor of its line of toggle-action clamps and pliers.

* * *

Bay State Abrasive Products Co., Westboro, Mass., has appropriated $250,000 for additional factory buildings and equipment. Expansion work is to start immediately.

* * *

Roeming-Lind Inc., Fairwater, Wis., has been formed to operate a commercial foundry. Directors are: Edward H. Roeming, Esther E. Roeming and Frank A. Nehring.

* * *

Holcroft & Co., manufacturers of heat treat furnaces, have moved their Chicago office to 4209 South Western Blvd. C. H. Martin is in charge of the office.

* * *

Stamford Research Laboratories of American Cyanamid Co., Boston Post Rd., Stamford, Conn., held an Open House May 19 for the first time since their establishment in 1936.

* * *

O'Connor Abrasive Sales, 277 Military Rd., Buffalo, has been formed by Eugene B. O'Connor. He handles abrasive lines manufactured by a number of companies.

Steel Founders' Society Honors Industry Veterans

STEEL Founders' Society of America honored three Pennsylvania steel foundry pioneers with individual records of 50 years of continuous service in the steel casting industry, at a dinner Apr. 14 in Philadelphia.

Honored were Marshall Post, vice president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; Harry K. Pollard, sales executive, Treadwell Engineering Co., Easton, Pa. and E. M. Schumo, executive vice president, Pennsylvania Electric Steel Casting Co., Hamburg, Pa. Special tribute was paid to G. Clymer Brooke, vice president, Birdsboro Steel Foundry & Machine Co., for his services as vice president and executive committee member of SFSA during 1949 and for other society activities.

Honors also were directed to 46 other industry executives with service records of 25 to 48 years.

E. M. SCHUMO

H. K. POLLARD

MARSHALL POST

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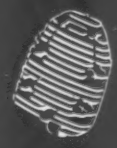
3 PRODUCE FINER DETAIL —  — use Krause cereal binders

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STANDARD SPECIFICATIONS FOR GRAY IRON CASTINGS

ASTM Designation: A 48-49. Adopted, 1936; Revised, 1941, 1948, 1949.

(b) In all cases, controlling dimensions shall be the diameter of the bar at fracture.

(c) The rate of application of the load shall be such that fracture is produced in not less than 15 sec for test bar A 0.875 in. in diameter, 20 sec for test bar B 1.2 in. in diameter, and 40 sec for test bar C 2.0 in. in diameter.

NUMBER OF TESTS

10. (a) The manufacturer shall prepare and furnish all test bars as agreed upon. Two or more test bars shall be cast.

(b) If any test specimen shows defective machining or obvious lack of continuity of metal, it shall be discarded and replaced by another specimen.

RETESTS

11. (a) In case of failure of a test bar to conform to these specifications, a retest may be made. If the retest fails, the castings shall be rejected, except as specified in Paragraph (b).

(b) As provided for in Section 3 (d), when the transverse or flexure test bar fails to conform to the specified requirements, a tension test specimen may be machined from a broken end of the transverse test bar. If this tension specimen conforms to the requirements of the specified class, the castings shall be accepted.

CHEMICAL COMPOSITION

11. It is the intent of these specifications to subordinate chemical composition to physical properties. The quantities of any chemical elements in the cast iron may be specified by agreement between the manufacturer and the purchaser.

WORKMANSHIP AND FINISH

12. The castings shall conform substantially to the dimensions on drawings furnished by the purchaser or to the dimensions predicated by the pattern supplied by the purchaser, if no drawing has been provided. The castings shall be free from injurious defects. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth. Runners, risers, fins, and other cast-on pieces shall be removed. In other respects the castings shall conform to whatever points may be specially agreed upon between the manufacturer and the purchaser.

INSPECTION

13. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

CERTIFICATION

14. Upon request of the purchaser, the manufacturer shall be prepared to certify that his product conforms to the requirements of these specifications.

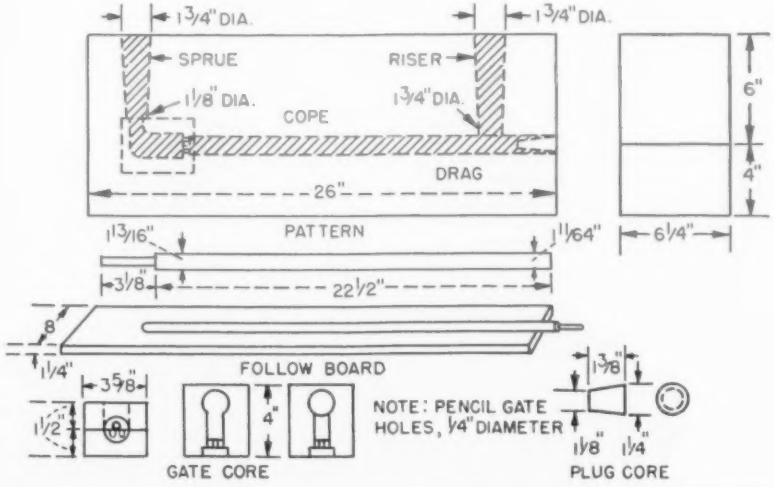


Fig. 3—Transverse or flexure test bar, 1.20-in. diameter; cast horizontally

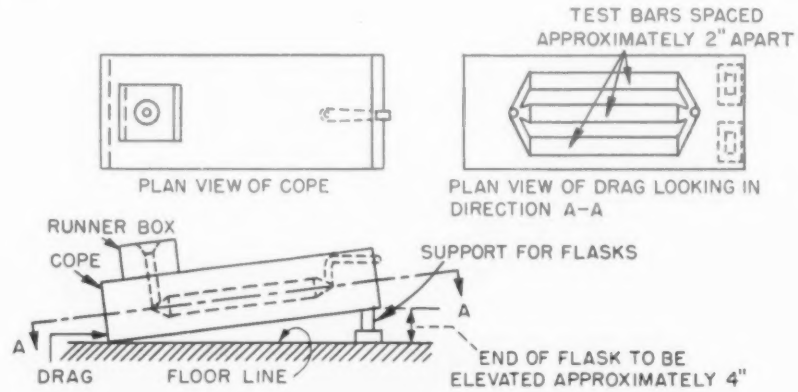


Fig. 4—Test bar cast on incline

STANDARD SPECIFICATIONS FOR GRAY IRON CASTINGS

ASTM Designation: A 48-49. Adopted, 1936; Revised, 1941, 1948, 1949.

Explanatory Notes

Note 1.—Classes Nos. 20, 25, and 30 cover the ordinary grades of gray cast iron. Classes Nos. 35, 40, 50, and 60 would be considered high-strength irons, particularly in medium and heavy sections.

Note 2.—The higher strength irons are usually more expensive to produce and machine.

Note 3.—In the transverse or flexure test, it is recommended that the deflections at fracture be recorded and reported.

The modulus of rupture for any bar tested under these specifications can be ascertained by application of the following formula:

$$\text{Modulus of rupture} = \frac{2.546LS}{D^3}$$

Where:

L = span length or distance between supports in inches,

S = breaking load in pounds, and

D = diameter of the test bar in inches.

Deflection values have been omitted from these specifications because the desired deflection would be governed by the use of the iron. In some cases a maximum value would be specified because a stiff iron is desired, and in other cases minimum values would have to be specified because a flexible iron is required. Consequently, the deflection figures should be reached by agreement between the manufacturer and the purchaser.

The use of modulus of elasticity gives a definite load-deflection relationship, which is superior to a specification for deflection unless that specification provides for increase in deflection with increase in load. The maximum modulus of elasticity could be specified if toughness is desired or a minimum value could be specified if stiffness is desired. For the 1.20-in. diameter test bar the formula for modulus of elasticity is as follows:

$$\text{Modulus of elasticity, psi} = \frac{\text{Load in pounds}}{\text{Deflection in inches}} \times 1194$$

Note 4.—Test bars shall be plain, cylindrical shapes as shown in Fig. 1. Where bars are cast on end, allowance for draft may be made. However, the diameter at the center of the length must correspond to the nominal diameter, within the permissible variations shown as follows:

Test Bar	Permissible Variations, in.
A	±0.05
B	±0.10
C	±0.10

Tension test specimens "cast to size" are not recognized in these specifications.

Note 5.—A sound test bar is desired. Several methods of making transverse or flexure test bars are shown in Figs. 3, 4 and 5. All of these methods of casting have been used and found to produce satisfactory results.

Note 6.—Test bars shall not be cleaned by tumbling unless the castings are so cleaned, or unless agreed upon by the manufacturer and the purchaser.

Note 7.—The use of ball and socket holders in the tensile strength test is recommended. Tests made under conditions where eccentric loadings may occur will give erroneous results.

Note 8.—A chart showing the approximate brinell hardness-strength relationships for cast iron* is shown in Fig. 6.

* J. T. MacKenzie, "The Brinell Hardness of Gray Cast Iron and Its Relation to Some Other Properties", Proceedings, American Society for Testing Materials, Vol. 46, p. 1025 (1946).

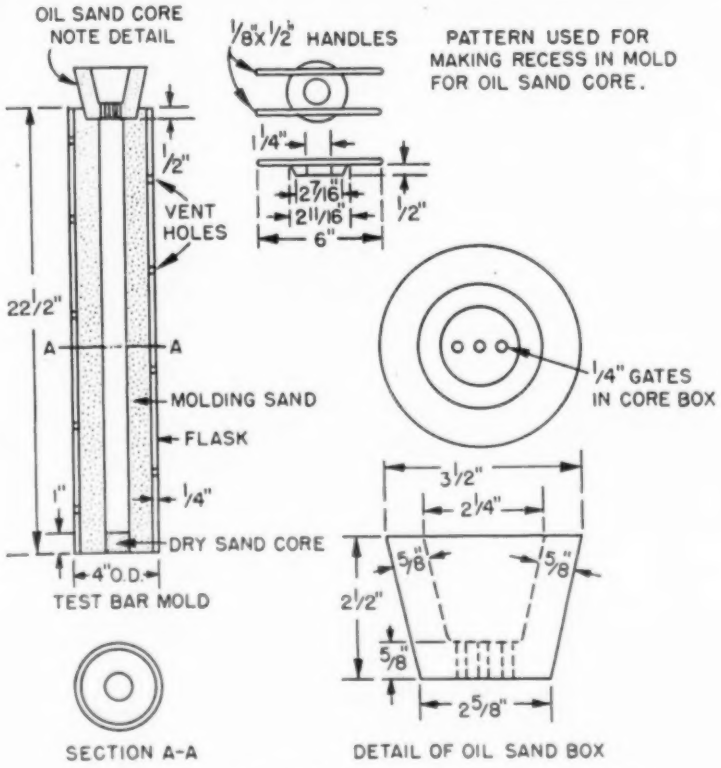


Fig. 5—Transverse or flexure test bar cast vertically

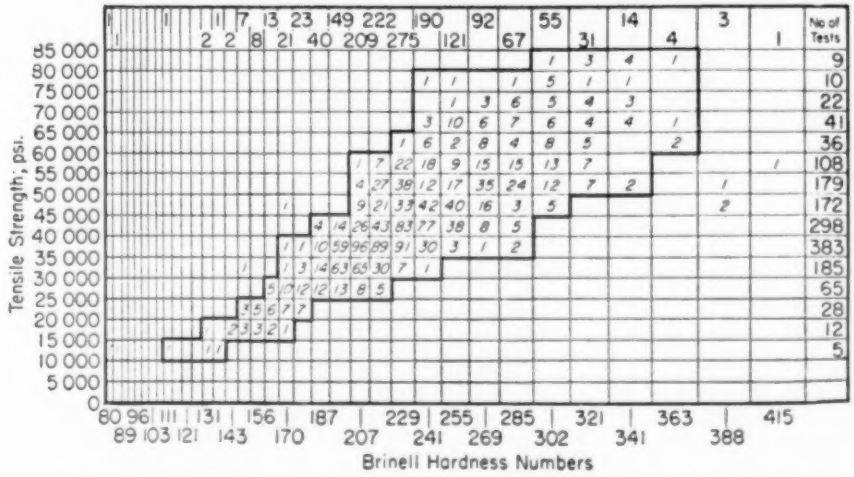
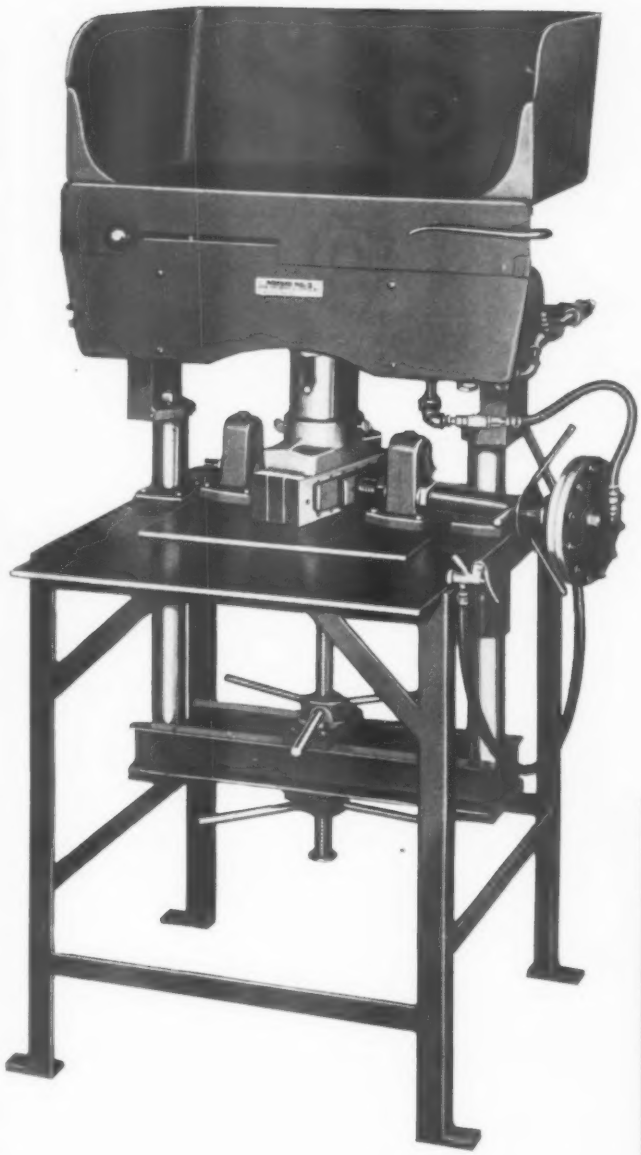


Fig. 6—Approximate brinell hardness-strength relationship for cast iron

Redford CORE BLOWERS



REDFORD NO. 2 STATIONARY MAGAZINE TYPE CORE BLOWER . . . . .

New standards are being set with this machine, because every motion of your operator has been correctly evaluated to obtain a maximum of production with a minimum of effort.

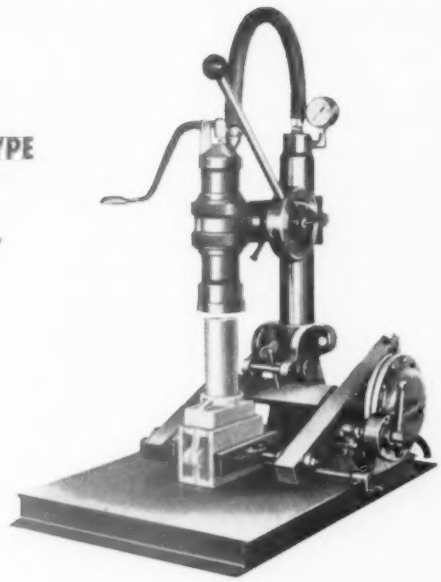
8 OUTSTANDING FEATURES:

1. Large stationary work area.
2. Large sand supply hopper.
3. Stationary sand magazine.
4. Easy accurate locating of core boxes.
5. Quick change magazine heads.
6. Quick adjustment for different height core boxes.
7. Quick change, fully adjustable, vertical clamping attachment.
8. Actuating one handle clamps the core box, blows the core and releases the core box, in two seconds.

CAPACITY: Cores up to 5#

Write for Specification Bulletin "F"

REDFORD CARTRIDGE TYPE BENCH CORE BLOWER . . . . .



The original small core blower . . Proven simplicity, speed and flexibility. Makes cores up to 2#.

Thousands in use in American Foundries . .

Write for Specification Bulletin "G"

Redford IRON & EQUIPMENT CO.

PHONE: KEnwood 1-8611

20733 GLENDALE AVENUE • DETROIT 23, MICHIGAN

By EDWIN BREMER

Foundry DEVELOPMENTS

MIDWESTERN malleable foundry produces large quantities of small castings for the automotive industry which must meet rigid brinell hardness specifications. The job of testing each piece manually was so great that attention was given to developing an automatic method. The machine now in use is based on the principle that magnetism retention is a function of hardness. Parts are fed into one end of the machine, magnetized and the amount of magnetism retained is measured. Cast parts meeting the standards are discharged at the far end of the machine while the soft pieces and those too hard are discharged on opposite sides and are sent back to the furnace for reanneal.

* * *

INTERESTING development directed at lowering die cost for the die-casting process is application of precision-molded alloy cast iron dies, according to Charles Franklin, General Motors Corp., Rochester, N. Y., in a paper at the recent annual meeting of the American Society of Tool Engineers. The cast dies have the desired cavities formed in place during the molding process, and require minimum finishing to fit them for use. Application at present is in production of zinc-base die castings.

* * *

RECENT advances in methods of applying metallic and nonmetallic coatings to gray iron castings have revolutionized previous ideas regarding the application of gray iron castings. Coatings of any desired metal can be produced by molten-metal spraying, dipping the castings in molten metal, heating in contact with molten metallic salts, electroplating using improved techniques, or deposition of required surfacing metal by oxyacetylene or arc welding methods. Nonmetallic coatings, including all types of organic and inorganic materials, are best applied by spraying, brushing or dipping followed by suitable baking or firing treatments. Properly coated castings exhibit immunity to the severest corrosive, wear and heat conditions. These developments, recently described and correlated in two technical bulletins issued to members of the Gray Iron Founders' Society, Cleveland, by C. O. Burgess, technical director, will enable the industry to take advantage of the substantial economies inherent in the use of a comparatively inexpensive base metal such as gray iron.

* * *

COMMERCIALLY feasible method for producing electrodeposits of cobalt or nickel alloyed with as much as 15 per cent phosphorus has been developed by Abner Brenner, Dwight E. Couch and Eugenia K. Williams, National Bureau of Standards. New phosphorus alloys are deposited more easily than chromium, are very hard, corrosion-resistant and bright, and should be of value for many applications in which chromium plate now is used. Plating baths are simply prepared and consist of common nickel or cobalt salts such as sulphates or chlorides to which is added phosphorus acid. Baths are operated at a low pH, between 0.5 to 1.5 depending upon composition, and are kept at 75° C or over. Current densities are between 5 and 40 amp per sq dm. At usual current density, 10 amp, rate of deposition is fairly high; amounting to a few thousandths of an inch an hour. Hardness of deposits as plated varies from 350 to 720 Vickers scale, increasing with phosphorus content. Heat treated at 400°C, deposits become harder—a heat treated cobalt-phosphorus deposit with 10 per cent P showing a hardness of over 1100 Vickers. Deposits are highly resistant to corrosion and chemical attack.

* * *

NEW liquid primer containing selenium is being marketed as a rust destroyer which is said to form a good paint base. Selenium combines with iron oxide to form a complex iron selenide which dries into a hard, dense substance impervious to moisture. Material is applied directly to rusted surfaces by brush or wiping it on with a cloth.

* * *

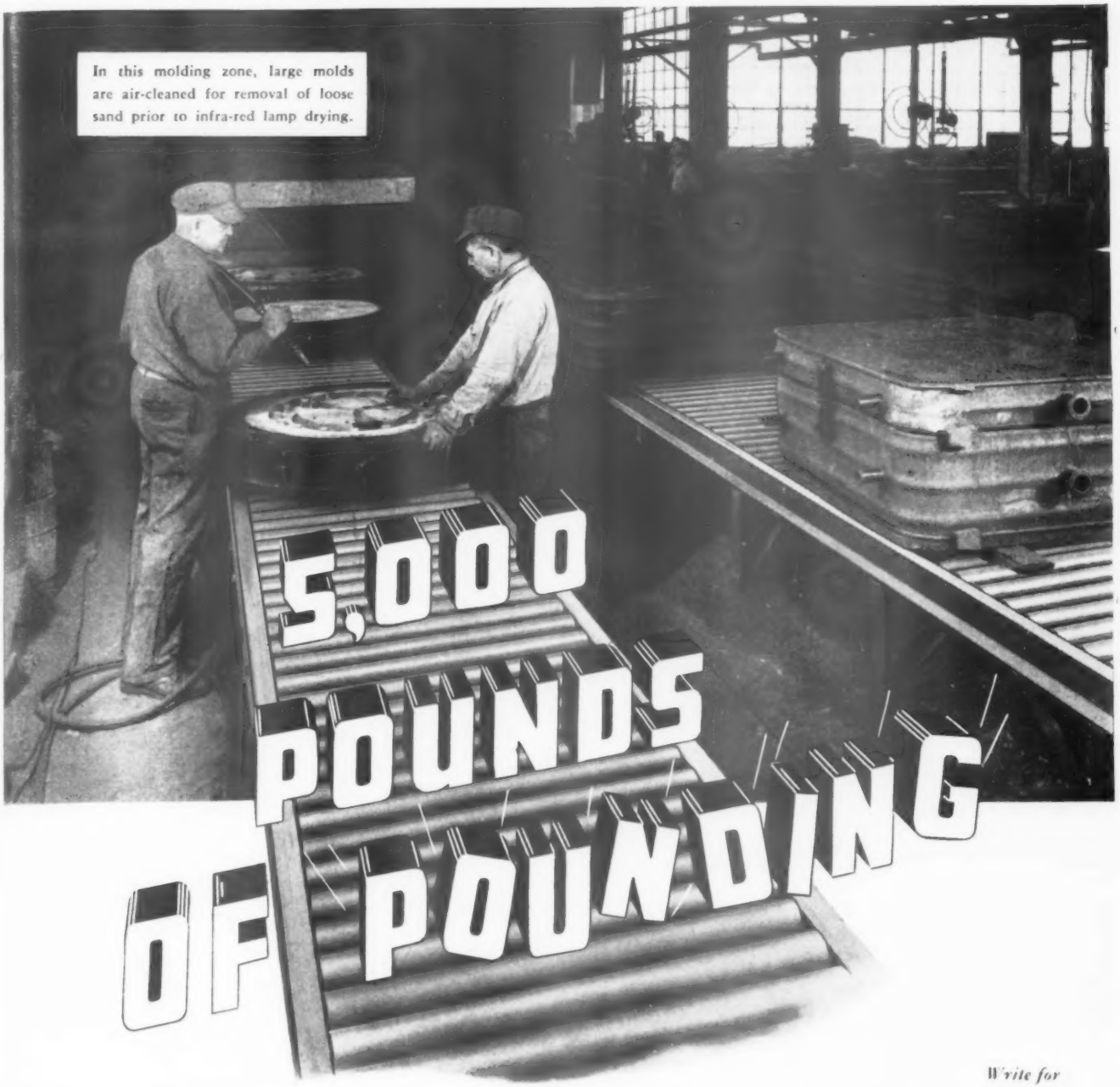
GREATLY expanding use of magnesium alloy wedges in logging operations due to light weight and ease of handling, has raised the question of a possible fire hazard in fragments broken from them in use. However, a careful study by E. M. Cramer and A. R. Hard, Division of Industrial Research, State College of Washington, Pullman, Wash., indicates that use of magnesium alloy wedges does not constitute a fire hazard. Study was in two parts. First was determination of the temperature to which a fragment of the alloy such as might be broken from the wedge by sledging, must be raised before it would ignite forest litter with which it would come in contact. Second was to determine if the heat developed in a fragment due to shearing by impact was sufficient to ignite it or raise it to a litter-kindling temperature.

* * *

FREEZING point of uranium has been measured to a precision of 2°C by A. I. Dahl and H. E. Cleaves, National Bureau of Standards. Previous difficulty was due to an oxidized casing or crust forming on uranium when heated in presence of most gases, and presence of small amounts of impurities. Procedure was to melt uranium of 99.94 and 99.6 per cent purity in an induction furnace under an atmosphere of helium, and hold for some time before determining the freezing point. Result was a purity of 99.9 per cent and a constant freezing temperature of 1133 plus or minus 2°C.

* * *

HARD coating for aluminum and its alloys which makes those metals eligible in many applications previously monopolized by alloy steels, has been developed in the engineering laboratory of Glenn L. Martin Co., Baltimore. Standard tests on an abrasion testing machine showed that aluminum coated by the new process had only half the wear of cyanide case-hardened steel after 50,000 cycles. The hard coating is applied by an electrochemical process which creates a nonmetallic, highly heat refractive surface, strongly bonded to the base metal. Coating thicknesses range from 0.0001 to 0.006-in.; abrasion-resistant uses as a rule call for 0.002-in. Surface smoothness is said to be closely maintained in general in processing, and hardness of the coating is considered "file hard."

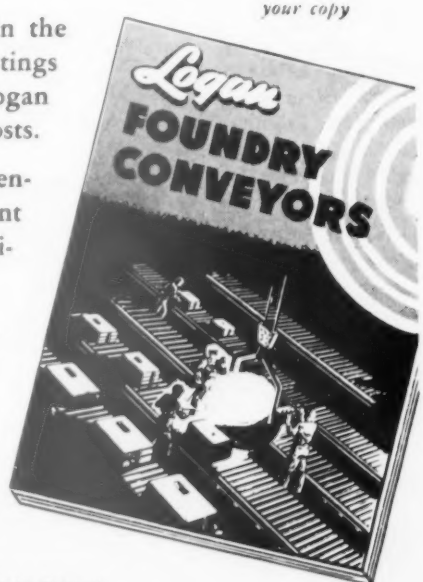

In this molding zone, large molds are air-cleaned for removal of loose sand prior to infra-red lamp drying.
5,000 POUNDS OF POUNDING

—is a lot of pounding, but Logan Conveyors take it all day long in the modern foundry. Molds weighing up to 2½ tons, heavy flasks and castings—whatever is to be handled—moves in controlled ease over Logan heavy-duty equipment. No break-downs here, no high maintenance costs.

Logan engineering and manufacturing skill are the products of two generations of heavy conveying experience. That is why Logan equipment has proved so satisfactory in scores of foundries—and finds such universal acceptance among foundry production men.

Now is the time to conveyorize to the limit. What are the possibilities in your foundry? Write for literature or for an engineer to call.

Write for your copy



Logan Conveyors

LOGAN CO. 580 CABEL ST., LOUISVILLE 6, KENTUCKY

Around THE COUNTRY

PITTSBURGH — Blowing out of Pittsburgh Coke & Chemical Co.'s blast furnace May 10 for relining has created a pig iron supply problem among a growing number of foundries. Some users are forced to substantially increase proportion of scrap in their charges. This lone merchant foundry iron stack in the district is expected to be blown in early in July, but some foundries must make inventories last two to three weeks longer, depending on grade of iron first produced.

Some iron has been available here from the Birmingham district, but at high prices due to freight involved. Similarly, iron from Germany can be purchased at $43, eastern seaboard. Some German iron also has been purchased by at least one foundry interest in San Francisco area at $48 delivered, in contrast to $56 delivered from Geneva, Utah furnace.

Sporadic improvement in orders is noted among jobbing shops. However, this group is operating but 2 to 4 days per week. Full schedules prevail among captive foundries serving electrical appliance, heavy industrial machinery and plumbing industries. Ingot mold producers also are very active; Vulcan Mold & Iron Co., Latrobe, Pa., broke a production record last month. In the brass plumbing fixture group, Acheson Mfg. Co., Rankin, Pa., also is operating at peak levels. Westinghouse Air Brake Co. has recovered from low monthly output of 200 control valves last December to current pace of around 1500 units. Revival in freight car building has aided some foundries here. Steel foundries have received military inquiries involving armor plate and shell components. This work, however, remains largely in the inquiry stage.

National Alloy Division, Blaw-Knox Co. is successfully utilizing oxygen in electric furnaces for producing high-alloy steels. Experience to date indicates ability to reduce carbon of about 0.20 down to 0.07 per cent in matter of minutes and at less cost. The parent company is expected to complete $1.5 million modernization program by early fall. Plans call for improved and enlarged heat treating furnaces at 62nd street to serve Union Steel Castings, Lewis Foundry & Machine and Pittsburgh Rolls Divisions. New and improved iron air furnaces and cupolas for production of iron rolls are being installed in the Lawrenceville district and will serve both Lewis Foundry & Machine and Pittsburgh Rolls Divisions.

Rumor has it that Fort Pitt Malleable Iron Co., last malleable iron interest in greater Pittsburgh area which closed Mar. 31, may re-open soon under new management. . . . Phillips Mine & Mill Supply Co. will discontinue foundry operations Aug. 1. This foundry is said to be the oldest in Pittsburgh district specializing in mine car wheels. . . . Monessen Foundry Division of Rockwell Mfg. Co., specializing in small castings for steel mill equipment, closed June 1.

A NEW DEPARTMENT

With this issue *THE FOUNDRY* introduces a new department—"Around the Country." An expansion of "Around Detroit," which had been presented monthly for many years, the new feature will cover other leading foundry centers as well. It will attempt to supply news concerning business conditions, companies and individuals that will interest all those identified with the foundry industry.

E. P. Buchanan, secretary-treasurer of Pittsburgh Foundrymen's Association, has been made manager of pig iron division of Pittsburgh Coke & Chemical Co. . . . Wm. J. Laird, another active member of PFA, has been transferred from Linhart nonferrous foundry to Feeder Division of Westinghouse Electric; George Miklos from Trafford foundry of Westinghouse will replace Mr. Laird at Linhart. . . . John A. Meyer has retired as vice president and foundry superintendent of National Alloy Division of Blaw-Knox Co. Martin Ornitz is the new foundry superintendent. . . . Erson V. Ogg, former operating vice president of McConway & Torley Corp., has been appointed director of industrial engineering at Chase Brass & Copper Co., with headquarters in Waterbury, Conn.

* * *

CHICAGO—"Profitless prosperity" applies to business conditions at many foundries around Chicago. Casting buyers are again pressing for lower prices. Materials and labor costs are up. Rush orders are in vogue.

Surprisingly, in view of the boom throughout the metalworking industry, foundry activity is extremely spotty. Job shops working six days a week are offset by those busy only three. Those working the full week generally have a large number of small orders in their shops. Conversely, the fewer the customers the less the activity. Exceptions, of course, are those shops with good automotive accounts. Some farm implement casting suppliers are operating below former high levels. This seems particularly true in the Tri-Cities region where several captive shops have reduced their melt.

Costs are increasingly worrisome. A new wage agreement between members of the Chicago Foundrymen's Association, comprising some 32 job shops located in Chicago, Joliet, Aurora and Batavia, and the area's conference board of the International Molders & Foundry Workers Union of North America—AFL provides a 3-cent hourly wage boost, this in lieu of insurance which the union sought.

Scrap, of course, is in a runaway market—$50 for No. 1 cupola cast was paid last month. Pig iron obtanied from usual sources is steady, but tight supply has forced some melters to pay premiums for foreign material. Use of the latter is not widespread here, but domestic iron sellers, scrambling to meet demand, believe more foreign offerings can be expected. Although 38 of the district's 42 blast furnaces are operating, steelmakers are reluctant to run on merchant iron too long because of their hot metal requirements. Casting buyers have pared inventories to the bone; so many of their orders are marked "rush."

* * *

NEW YORK—Gray iron foundrymen in the New York metropolitan area find operations a bit disappointing. Some specialty shops are doing well, but jobbing foundries are unable to operate more than four days a week on an average. With the vacation season at hand, operators doubt if even the present rate can be maintained.

Two Irvington, N. J., foundries.

(*Concluded on page* 112)

FERRO MANGANESE FROM TENNESSEE

You can save freight costs by ordering mixed cars of Ferro Manganese, Ferro Silicon and briquettes. Specify standard grade lump, regular sized or briquettes in bulk or containers.

Test Tennessee's dependability—place an order for your next requirement of Ferro Manganese.

AGENTS:
Miller & Co., Chicago, St. Louis, Cincinnati
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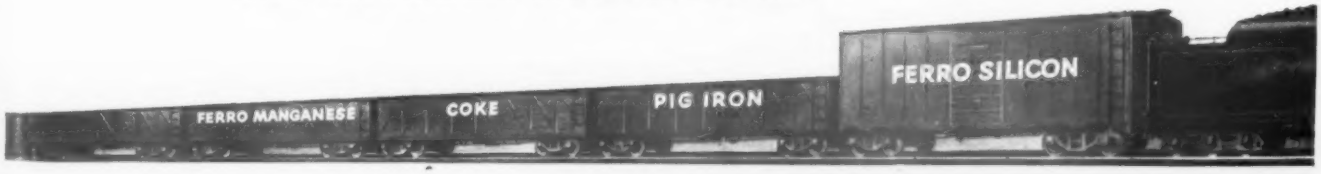
EXPORT AGENT:
Ore & Ferro Corporation, 30 Broad St., New York

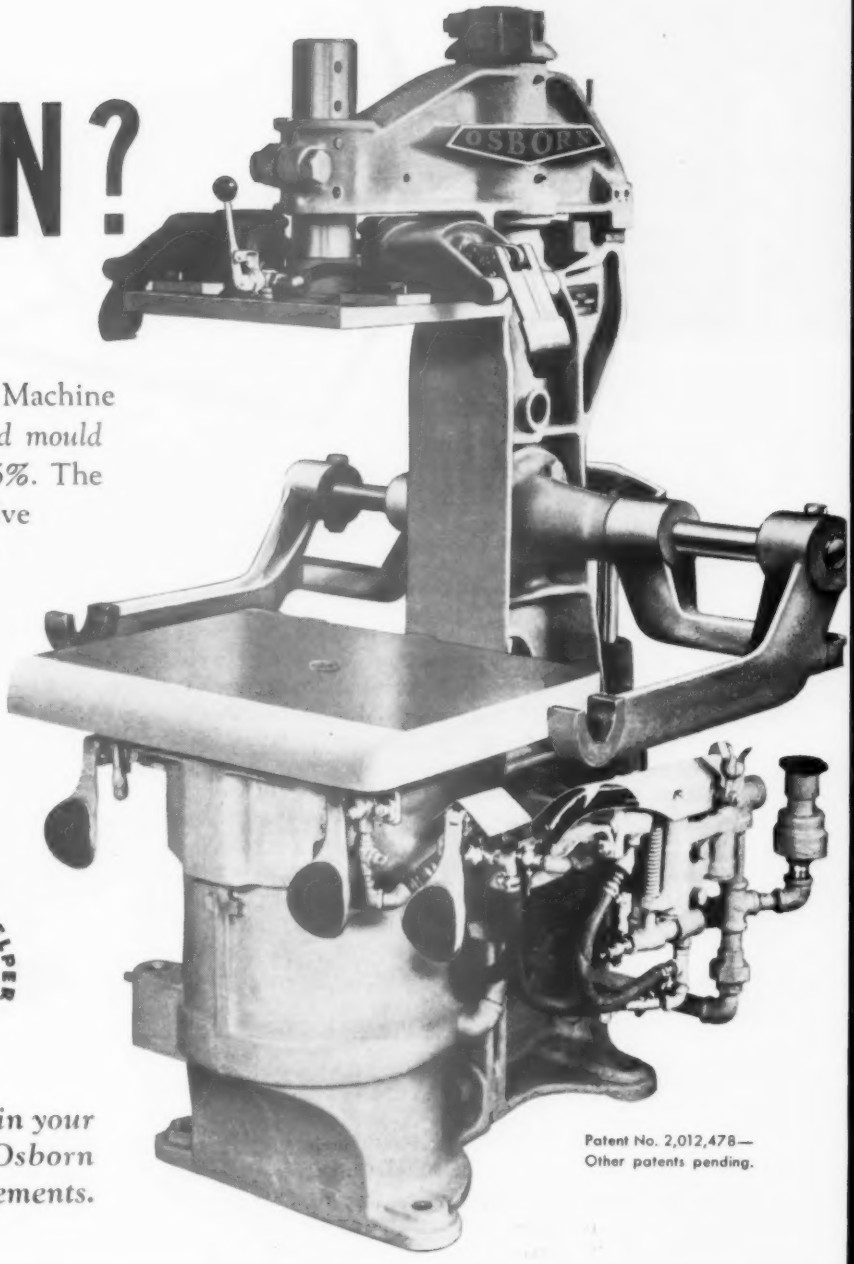
TENNESSEE PRODUCTS & CHEMICAL Corporation
NASHVILLE, TENNESSEE



HOW MUCH CAN THIS NEW ROTA-LIFT INCREASE YOUR

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue Cleveland, Ohio

OSBORN PRODUCTION?



THE new Osborn ROTA-LIFT Moulding Machine installation shown has *already increased mould production* at this foundry by *more than* 75%. The ROTA-LIFT mechanically performs the five major operations in making moulds from large match plate patterns. In addition to conventional *jolting* and *squeezing*, it *rolls over, draws, and closes the mould* as shown in the pictures below. The new Osborn ROTA-LIFT conserves the physical energies of your moulders . . . makes your foundry a better place in which to work.

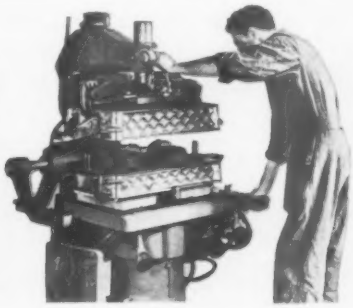
OSBORN
ROTA-LIFT

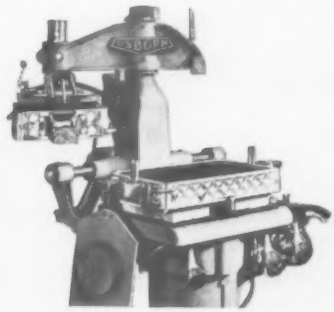
THE MOULDER'S HELPER

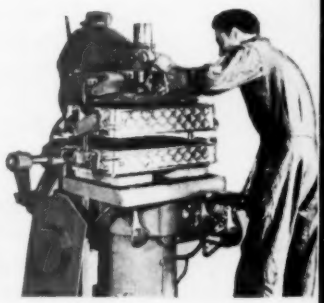
Similar savings are undoubtedly possible in your foundry, too. Request an experienced Osborn Foundry Engineer to analyze your requirements.

Patent No. 2,012,478—
Other patents pending.

Rolling Over


Drawing Cope


Handling Cope


Closing

OSBORN

MOULDING MACHINES CORE BLOWING MACHINES

MANUFACTURERS ASSOCIATION, INC. FOUNDRY EQUIPMENT

(*Concluded from page* 108)
however, have recently been able to step up operations well above average. Barnett Foundry & Machine Co., that city, is now serving all of the Meehanite customers of the F. W. Butterworth & Sons Co., Philadelphia, which earlier in the year closed its foundry department. In addition, Barnett is also handling some of Butterworth's own casting requirements.

Bierman Everett Foundry Co., Irvington, has acquired the accounts and patterns of the Roselle Foundry Co., Roselle, N. J., and is increasing its production. Bierman also acquired from the Roselle plant some equipment. The plant and remaining equipment is now up for sale. The Roselle plant had a capacity of around 7 to 10 tons daily.

Demand for nonferrous castings has been featured principally by specifications for aluminum alloys. Brass foundry operations have been lagging.

* * *

PHILADELPHIA — District iron jobbing foundries are operating at over 39 hours a week on an average; some as much as 45 hours. Activity is ascribed in part to the catching up on work delayed earlier in the year by the prolonged labor disruption which affected many shops here. However, there has been a slow but steady pickup in new demand for castings. Specialty shops, particularly pipe foundries and makers of sanitary ware, have been going full tilt for some time. Pressure pipe foundries have enough work on their books to sustain current operations the greater part of the summer.

District foundries have been buying more foreign iron; this is due not only to the tighter supply of scrap and domestic iron, but also to the attractive prices on foreign iron.

* * *

WASHINGTON—The Foundry Industry Advisory Committee to the Munitions Board, and the ten advisory sub-committees covering various phases of the castings industry, now have been organized. During June, six subcommittees met at the Pentagon Building here.

The Subcommittee on Gray Iron Castings, with Walter L. Seelbach, Superior Foundry Co., Cleveland, as chairman, met June 14; a joint meeting of the Steel Castings and Cast Armor Subcommittees, with Thomas H. Shartle, Texas Electric Steel Casting Co. Inc., Houston, Tex., and A. J. McDonald, American Steel Foundries, Chicago, as co-chairmen, met June 15; the Subcommittee on Brass and Bronze Castings, with Edwin W. Horlebein, Gibson & Kirk Co., Baltimore, chairman, met June 16; the Subcommittee on Aluminum and Magnesium Castings, with O. L. Earl, Acme Aluminum Foundry Co., Chicago, as chairman, met June 21; and the Cast Iron Pipe Subcommittee, with Donald Armstrong, United States Pipe & Foundry Co., Burlington, N. J., as chairman, met June 23.

Other subcommittees which previously held organizational meetings are: Subcommittee on Foundry Equipment whose chairman is Thomas Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh; Subcommittee on Foundry Supplies whose chairman is F. Ray Fleig, Smith Facing & Supply Co., Cleveland; Subcommittee on Malleable Iron Castings whose chairman is Collins L. Carter, Albion Malleable Iron Co., Albion, Mich.; and the Technical Subcommittee whose chairman is Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Acting on a recommendation by Ralph R. West, West Steel Casting Co., Cleveland, the Munitions Board is arranging to query a large number of companies to determine the extent to which small businesses participate in military procurement through subcontracts placed by prime contractors. Approval by the Bureau of the Budget is needed to carry on this study on the desired large scale. Meanwhile the board is making a spot check of a limited number of small companies to get a sample. The study is necessary to enable the Department of Defense to carry out a Congressional mandate that small business be given a fair chance at the procurement by the army services. Mr. West made his recommendation on behalf of a subcommittee of the Munitions Board Industry Advisory Committee on Military-Contractor Relationship which had been asked to look into the matter.

Meetings of Interest to Foundrymen

July 28—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 13-16—National Association of Foremen, annual convention, Statler Hotel, Buffalo

Sept. 25-26—Steel Founders' Society of America, fall meeting, The Homestead, Hot Springs, Va.

Sept. 28-30—All Canadian Foundry Conference, Royal Connaught, Hamilton, Ont.

Oct. 5-6—Texas Regional Foundry Conference, Plaza Hotel, San Antonio, Tex.

Oct. 12-14—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 12-13—Gray Iron Founders' Society, annual meeting, Netherland Plaza Hotel, Cincinnati

Oct. 13-15—Non-Ferrous Founders' Society, annual meeting, Hotel Statler, Boston

Oct. 23-27—National Metal Congress and Exposition sponsored by American Society for Metals, American Welding Society, Metals Branch—American Institute of Mining and Metallurgical Engineers, and Society for Non-Destructive Testing, International Amphitheatre, Chicago.

Oct. 27-28—New England Regional Foundry Conference, New England Foundrymen's Society, Massachusetts Institute of Technology, Cambridge, Mass.

Nov. 2-3—Metals Casting Conference, sponsored by Purdue University with Central Indiana and Michiana Chapters of AFS, Purdue University, West Lafayette, Ind.

Nov. 9-10 — National Foundry Association, annual meeting, Edgewater Beach Hotel, Chicago

Nov. 9-11—Steel Founders' Society of America, annual technical and operating conference, Carter Hotel Cleveland

Nov. 10-11—Michigan Foundry Conference, sponsored by Michigan AFS chapters and Michigan State College, Michigan State College, East Lansing, Mich.

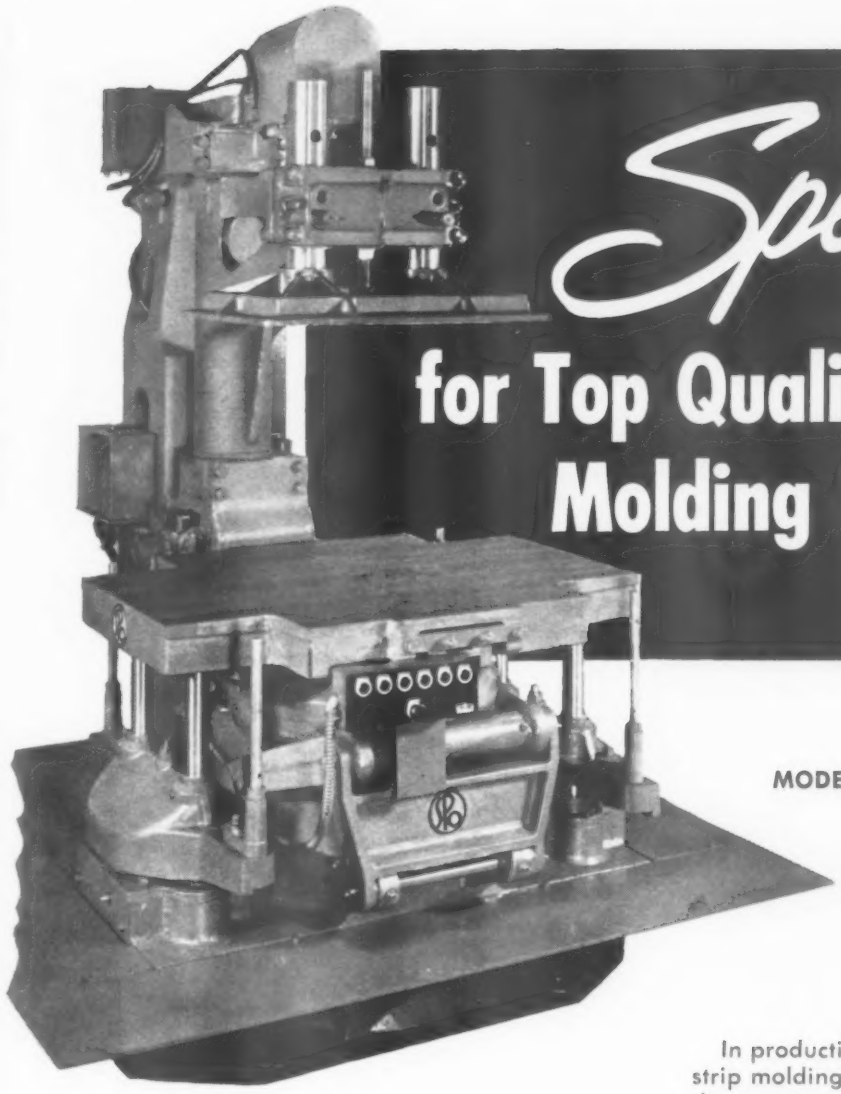
1951

Feb. 22-23—Birmingham Regional Foundry Conference, Birmingham District Chapter of the AFS, Tutwiler Hotel, Birmingham

Apr. 23-26—American Foundrymen's Society, annual convention, Buffalo

June 18-22—American Society for Testing Materials, annual meeting, Atlantic City, N. J.

Nov. 15-16 — National Foundry Association, annual meeting, Waldorf-Astoria Hotel, New York



Specify SPO for Top Quality Production Molding Machines

MODEL No. 2222

JOLT–SQUEEZE–STRIP MOLDING MACHINE

● Today's production requirements are higher than ever—and only SPO has designed its foundry equipment to meet these demands.

CHECK THESE FEATURES: Push Button Control . . . Fully Automatic Cycle . . . Famous SPO inverted jolt mechanism . . . Powerful Squeeze performed by 22" diameter cylinder . . . Dual-mounted squeeze plate . . . Automatically aligned Stripping Mechanism . . . and Automatic Pattern Draw at the desired pre-set speed of operation.

In production, Model No. 2222 jolt-squeeze-strip molding machine is operated entirely by the sequence-arranged push buttons to perform all functions. In addition, jolt-squeeze and vibration operations are timer-controlled to assure production quality of cope and drag molds of uniform standard. Squeeze capacity of this new molding machine is 28,000 pounds and the jolt capacity is 2500 pounds. Model No. 2222 automatic machine has a 36" x 51" table and pattern draw of 12".

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Jolt-Clamp-Rollover-Draw machines are described in catalog series No. 9000. Publication illustrates sequence of operation and charts specifications.

Layout Protractor Table is covered in detail in No. 30 series catalog. Worm gear actuation and hand-wheel control mechanism are described.

Jolt-Rollover-Squeeze-Draw machines are described in Bulletin No. 9. Photos show machines in actual operation. Production figures and construction features are included.

Molding Machines and Vibrators are featured in catalog No. 40. More than 21 different types of molding machines are shown, and complete line of foundry vibrators is covered with specifications.

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MAN·TO·MAN on the Molder's Bench

"Theory and Practice"

By RALPH L. LEE

THE older I get the greater seems to be the spread between *knowing how a thing can be done* and *being able to do it myself*. In fact, it's amazing sometimes how ignorant a person can be and still do pretty good work and, on the other hand, how highly educated others are who have one heck of a time putting anything they know into practice.

My son Ralph and I were talking some time ago about measuring. He was showing me a wooden tool box he was making; he had it all cut out, ready to glue together. While he didn't come right out and brag, he was in the mood and, by golly, he had every right to be, because he had tenons and the miters on that job so that they would really fit. The whole thing went together just as square as a die with no cracks showing.

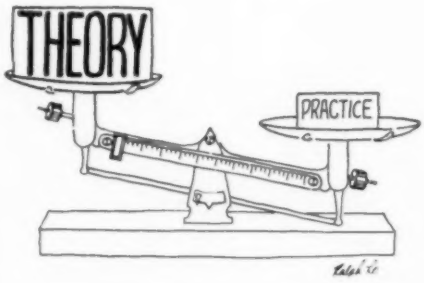
He was laughing at the agony he used to go through when he first started out in wood work. He said he had had the same kind of measuring tape and scale he uses right now, just about the same tools and material, and he didn't think he knew any more about the graduations on the tape and rule than he did when he began. I chimed in at this point with, "Well when you get right down to it there's only just about so much anybody can learn about a scale. There's the inches, the halves, quarters, eighths, sixteenths, thirty-seconds and maybe sixty-fourths with lines. All you've got to do is to pick the right line, get your pencil or scriber right in the center of the old line, and there you are—that's about all anybody can do, I guess."

Then we both agreed that after you had memorized all there is about reading a scale and about setting and operating a saw, a jointer, a planer, a sander or what have you, you're not even started. Whatever happens to a fellow between the time he botches up his first attempt at a job and the day when things go together like Ralph's tool chest, it can't very well be put down in black and white as a fool-proof recipe which will guarantee similar results to even the most highly educated green-horn.

I'd be the last person on earth to thumb my nose at book learning in any form or in any reasonable quantity, for the Lord only knows that few of us have half enough. But here lately I'm beginning to think that we may be going a bit hog-wild in the belief that the more we know the more and the better we will do. There seem to be more and more people who believe that cramming the old noggin with a lot of answers for quizzes of one kind or another or I. Q. tests is a sure-fire short cut around the sweaty old cut and try, drill and practice route.

I think that maybe the atom bomb is partly responsible. We hear and read an awful lot about electrons, protons, neutrons and stuff like that, and look at pictures of high-domed geniuses seated at their desks with their slide rules and thick books forcing nature to give up her secrets by pure unadulterated reason.

Well, in spite of appearances, if it hadn't been for the accidental discoveries stumbled upon by common ordinary old plodders bungling along on the daily grind there couldn't be geniuses sitting at their desks trying to piece together these accidental discoveries into some sort of an understandable pattern.



If I don't look out here, I'm going to get in clean over my head in my effort to make a few points I really think ought to be made.

If I were a young fellow leaving school to go to work for the first time, I believe (knowing what I now know) I'd thank some older person for pointing out to me in no uncertain terms that all of the facts I had gotten out of books and memorized so far, were in themselves only *tools*. Like other tools these facts aren't worth a whoop until they are actually put to use trying to get jobs done. The knack of using these tools cannot be gotten out of books.

Then here's another thing. I believe I'd go rather slow setting up standards of book learning and school credits as an arbitrary riddle for screening all applicants for jobs and candidates for promotion. It's nothing short of a miracle how organizations manage to stay in one piece during drastic changes in management; maybe the invisible cement that holds them together is that impossible-to-describe doability scattered among the old stand-by foremen and operators. Anyway, it doesn't show on the organization chart and may lie beyond the bounds of pure reason and the printed word.

There might also be something in this rambling to help those who didn't go to college, or even to high school, to perk up a bit in the presence of those who did. There is more than one way of skinning a cat. The proof of the pudding is in the eating and, after all, we are in the casting business and all of our tools—including book learning—have got to pay for themselves in terms of castings leaving the shipping platform at a price people will pay.

On the other hand, we will all want to keep after ourselves and the gang to lap up all the news and facts we can get from any source, and as a must see to it that the kids get all the book learning they can hold while the getting's good.

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Technical Reports

—AFS CONVENTION

Concluding reports on technical sessions held during the recent national meeting of the American Foundrymen's Society in Cleveland are presented here. Sessions devoted to malleable iron, patternmaking, brass and bronze, heat transfer, aluminum and magnesium, and nodular iron were covered by reports published in the June issue

A MANAGEMENT functions and controls session, under the joint sponsorship of the Foundry Cost Committee and Time Study and Methods Committee, was introduced for the first time during the 1950 AFS convention. It attracted considerable attention. Ralph L. Lee, Grede Foundries Inc., Milwaukee, served as chairman and Victor E. Zang, Unitcast Corp., Toledo, was co-chairman.

First paper, entitled "Administration of Wage Incentives," was presented by C. T. Hassell of Lester B. Knight & Associates, Chicago. He said the basic principle of a wage incentive is payment of wages on the basis of output rather than by the hour. To accomplish its purpose, a wage incentive plan must have the approval and full co-operation of both supervision and labor. Management should carry out a program for instructing both foremen and labor representatives in the basic principles of time study, how the rates are determined and the part that each must play in administering the plan. The speaker pointed out that production standards are the foundation of wage incentives since they influence not only wages but also costs and selling prices and therefore should be fair to both labor and management.

Time study procedure then was reviewed and these points emphasized: Time study should be preceded by process analysis; each element of work should be timed separately instead of timing the job as a whole; rates should be supported with detailed specifications of method and work to be done; adequate procedures for counting production should be provided and reasons for down time and special allowances should be re-

Below and on succeeding pages are shown some of the displays of equipment and supplies exhibited at the Foundry Show in Cleveland

ported. Mr. Hassell stressed the necessity of maintaining a fully qualified time-study department whether manned by one man or ten.

In subsequent discussion, the question was asked if 25 per cent over the base rate is sufficient incentive. Mr. Hassell stated that the percentage figure is gradually increasing and he remembers when 15 per cent was sufficient, but he judged 25 per cent is now a good average. In response to a question on making time studies of high-speed operations, Mr. Hassell suggested using a wire recorder to tap signals indicating beginning and ending points.

Second paper of the management session was presented by Wally E. George, associate of Booz, Allen & Hamilton, Chicago, on the subject "Organizing Management for Profit."

Mr. George pointed out that foundries in general are operating at about 50 per cent of their 1943 rate of production. He then outlined methods of organizing management to operate profitably at these lower levels. Using an organization employing 200 to 400 people as an example, Mr. George listed the seven levels of authority in the management of a company. Any corporation has as its top level the stockholders, followed by the directors, president, operating committee—comprised of the vice presidents who pool their judgment and experience to assist the president in his major decisions—the officers and managers of the major divisions or departments, followed by the department heads and lastly the foremen.

The speaker stated there are five steps in providing greater assurance of success in business: Establish and define major divisions, departments and sections required to embrace all operating elements; agree upon an operating plan of organization and spell out the functions of each unit; clarify the understanding of relationships among the major divisions and within their subdivisions; determine the executive or supervisory positions and decide on personnel requirements; provide a clear delineation of authority, responsibilities and duties assigned to each individual.

The speaker then presented an organization chart listing the responsibilities of each of the seven levels of management and their specific duties. He pointed out that every company's organization chart is different and changes occur rapidly. He therefore urged each company to develop a chart for its management organization and review it frequently to be sure that lines of authority are defined accurately and adhered to.

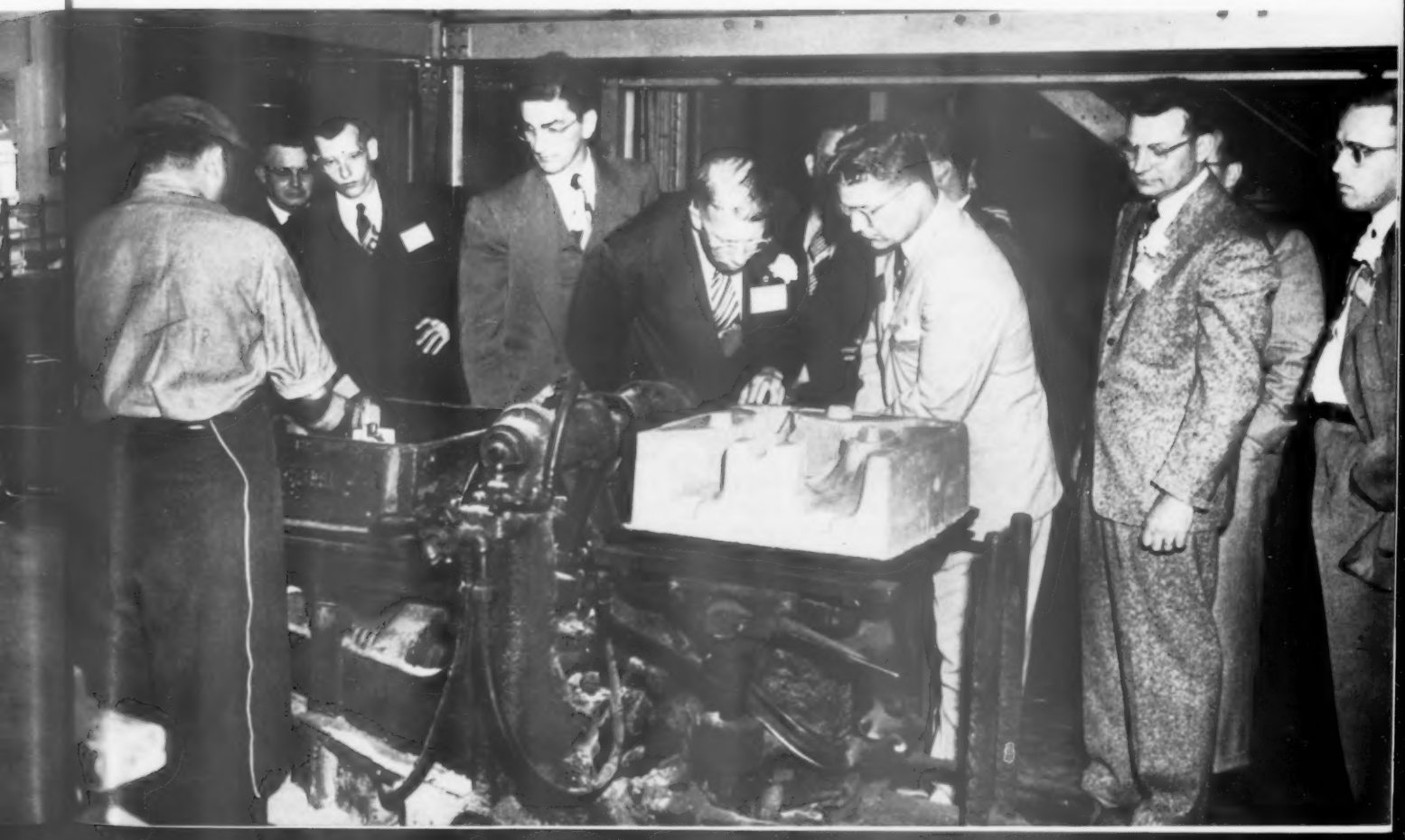
These benefits from a formalized management structure were cited by Mr. George: Top executives will not be bogged down with routine or detail; they will have time for constructive thinking and will have internal assistance to guide their judgment. Decisions will be more prompt and direction more purposeful, controls will be enhanced, supervision strengthened and greater profits will emerge.

Two papers were included in a subsequent program sponsored by the Time Study and Methods Committee and conducted by E. G. Tetzlaff, Pelton Steel Casting Co., Milwaukee. M. T. Sell, Sterling Foundry Co., Wellington, O., acted as co-chairman.

In his paper, "Standard Data for Bench Coremaking," H. R. Williams, Williams Management Engineering, Milwaukee, presented principles followed in applying standard data measurement to that operation in a jobbing steel foundry. Only those elements considered as presenting a measurement problem were discussed.

Methods were described for application of standard measurement to a fill and ram operation. Instructions were given for determining base curve for filling and ramming a Class I box, preparation of summary sheet for development of base curve and from which additional fill and ram information can be derived. Description included means of developing separate standards for tucking, strike off, slicking, draw time, split box assembly, loose pieces and other operation elements. Bench coremaking standards developed according to the principles presented in the paper are

About 750 foundrymen visited Cleveland plants during the convention. A few of the Aluminum Co. of America's 122 visitors are shown here



used successfully by many foundries.

Discussion following the talk brought questions concerning classifications for specific problems, multiplying factors to be considered for various types of sand, and other questions regarding separate standards.

The second paper, "Fatigue Data Summary," by M. E. Annich, American Brake Shoe Co., Mahwah, N. J., was the first report on fatigue data received by the AFS Timestudy and Methods Committee from various members in response to a questionnaire sent to foundries the latter part of 1949. Since 27 of the 54 reporting plants applied fatigue in whole or in part on an overall basis, the first report dealt with this method. Attempt was made to summarize all the data by operation, and by weight or flask size in those operations, and show the averages of the values reported. From the reported values a table of "ideal" average values on various operations was set up and formulas were derived for application of overall fatigue allowances to various operations where reported data were sufficient, based on weight or flask size.

Carry on Study

Mr. Annich emphasized that this first report represents what foundries are doing. Fatigue values developed are to be applied over all the elements of an operation. A subsequent report or reports will deal with methods of applying fatigue allowances on an elemental basis, and with special methods in use by other plants which the committee received in response to the questionnaire.

Importance of determining what elements comprise the expenses of casting manufacture, combined with development of plan to accumulate and record these expenses, was emphasized by J. A. Wagner, Wagner Malleable Iron Co., Decatur, Ill., in his paper on "Management Views Costs" at the foundry cost session. Regardless of modern equipment or the high plane of personnel, a company can succeed only if it has profitable sales. Consistent profit is not possible unless costs are known, hence a thorough study of costs factors is a prime function of management.

Advantages of developing a sound system of grouping and distributing costs to determine the cost of an operation or related series of them were illustrated by Mr. Wagner. He also contended that control of expenses is needed to reproduce today's costs tomorrow, so that estimated costs can be realized in actual production during such times when wage rates, material and supplies remain relatively constant in price.

The discussion period was limited largely to various methods used in accounting for scrap losses and in the development of practical cost data resulting from installation of new production facilities.

R. L. Lee, Grede Foundries Inc., Milwaukee, presided; George Tisdale, Zenith Foundry Co., Milwaukee, was co-chairman.

Educational . . .

NEED for better co-operation between the secondary schools and the foundry industry was emphasized at the first of two sessions sponsored by the Educational Division during the convention. This meeting was presided over by A. W. Gregg, Whiting Corp., Harvey, Ill., with W. H. Ruten, Brooklyn Polytechnic Institute, Brooklyn, co-chairman.

The subject was introduced by W. J. MacNeill, Dayton Malleable Iron Co., Dayton, Ill. In an excellent summary of how secondary school students can be prepared for a foundry career, Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O., pointed out that industry as a whole has been guilty for many years of complaining about the failure of schools to provide more practical education, without making a positive effort to suggest and encourage an educational program designed to bridge the gulf between pure theory and practice. He declared it is futile to talk about broadening educational horizons without planning to have much discussion with those school people who formulate curriculums. Mr. Rentschler listed the following steps as desirable in obtaining the desired co-operation with the schools:

1. There should be sustained liaison between foundrymen and school authorities to assure opportunities for potential workers to master specific information and skills which will function in the industry.

2. In a community where it can be justified, the industry should encourage the schools to establish a school foundry for use in the industrial arts and vocational programs.

3. Students desiring to enroll in the vocational foundry course should be screened by tests that will reveal their degree of aptitude and their mastery of desirable knowledge.

4. Students of the highest capacity for successful foundry careers may need, and in such cases should receive, assistance for the completion of their formal education in institutions of higher learning.

The concluding paper, a discussion of what secondary schools can do to prepare students for foundry careers, was prepared by James H. Smith, Central Foundry Division, General Motors Corp., Saginaw, Mich., and was presented by Verne Righter of that company.

Stressing the need for a closer co-operation between industry and the schools, the paper gave these recommendations: Provide plant tours for the students, starting in the ninth grade; invite capable speakers to discuss the foundry industry; make aptitude tests available to the school counsellors; provide facilities for training; arrange for visits by instructors to local foundries in order that they may become familiar with foundry developments; give physical examinations to students to prevent their being turned down later when applying for a job; prepare personnel files on the students, and rate them annually for the information of the prospective employer; make it possible for students over 18 years of age to receive credits for work while attending night school. Some of these recommendations were indicated as being desirable only in those areas where a high concentration of foundries exists.

Describes Training Program

An evening dinner meeting was presided over by the Educational Division Chairman, B. D. Claffey, Acme Aluminum Alloys, Inc., Dayton, O., with George K. Dreher, Foundry Educational Foundation, co-chairman. A detailed description of the comprehensive apprentice training program of the Caterpillar Tractor Co., Peoria, Ill., was presented by Frank W. Shipley, foundry manager. This paper was prepared by Mr. Shipley and B. L. Bevis, supervisor of foundry and pattern shop training at Caterpillar. The foundry apprenticeship is four years or 8000 hours. A similar period of training is required of the wood and metal patternmaking apprentices. Classroom training includes subjects not only necessary to the trade but also general ones such as economics and industrial organization, which tend to broaden the appreciation of industry in general and the system of free enterprise.

The concluding talk, presented by N. J. Stickney, Department of Metallurgical Engineering, University of Wisconsin, Madison, Wis., comprised a report on a poll taken among engineering students to obtain their analysis of the programs offered by

(*Continued on page* 120)

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"CAR FOR CAR"
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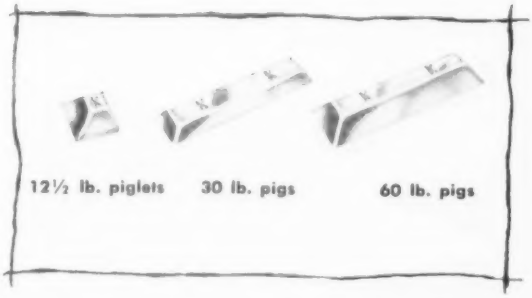

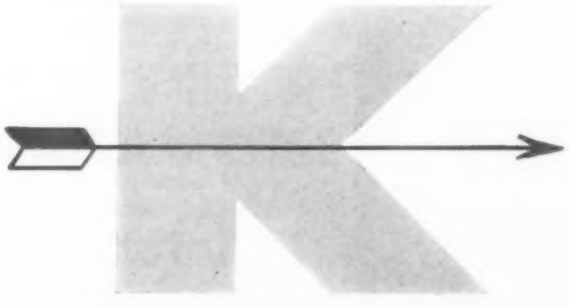

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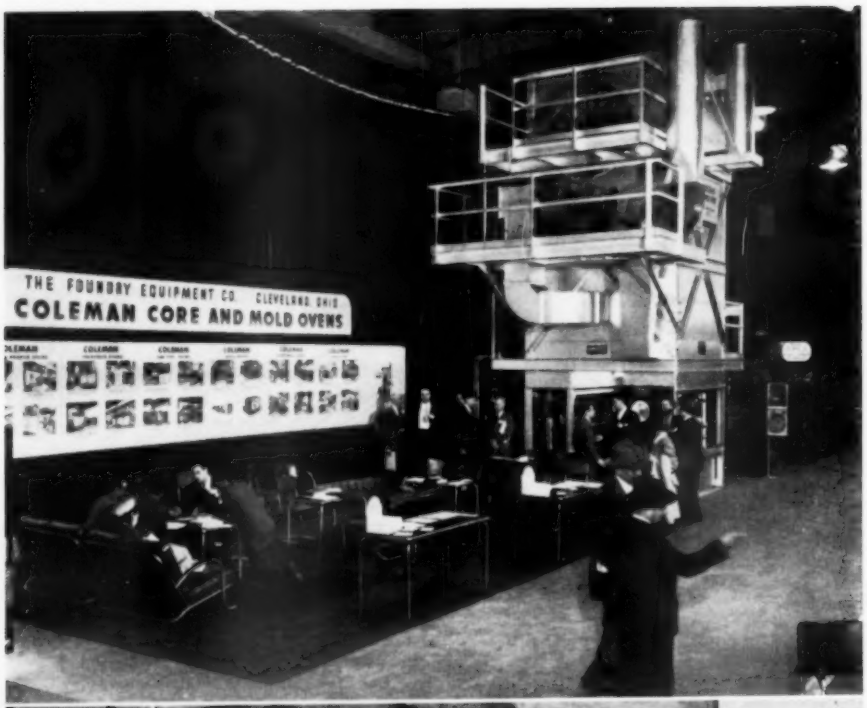


(*Continued from page* 118)

various foundries for summer employment last year. All of the student workers who participated in the poll were satisfied with the result of their summer's work. While a few were extremely critical, the majority found opportunity and interest on their behalf which exceeded their expectations. They felt that the organizations had provided an excellent opportunity to learn as much about foundry practice and control as was possible during the summer period. As one student put it, "If a student keeps his eyes and ears open and asks questions tactfully, he can gain much from his summer job."

Refractories . . .

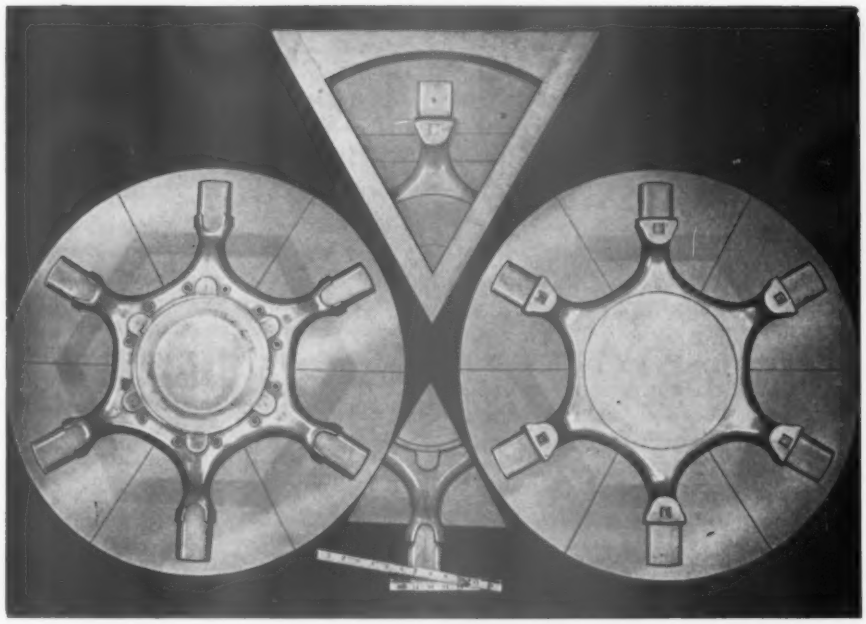
REFRACTORY practice in acid electric steel melting was discussed at the technical session sponsored by the Refractories Committee. A paper on this subject by R. H. Jacoby, metallurgist, and Marshall Petty, melting forman, the Key Co., East St. Louis, Ill., was presented by the former. Richard H. Stone, Vesuvius Crucible Co., Pittsburgh, was meeting chairman and Ray A. Witschey, A. P. Green Fire Brick Co., Chicago, was co-chairman.

Mr. Jacoby described relining procedure for a 1¾-ton direct-arc electric furnace with a top charge, swinging roof. Silica brick is employed and the assembly is finished off with a layer of gannister mix of 30 per cent Firegan (⅜ in. and smaller rock gannister), 30 per cent fire clay, and 30 per cent coarse silica sand. Furnace bottom is carefully worked to a bowl shape, using a wooden gage from the charging door sill and the spout, and maintaining a depth of 14 in. from the center of the gage to the rammed furnace bottom. The area in front of the spout is shaped to insure the even and complete emptying of the furnace when tilted for tapping. Upon completion of the "ram-in" a wash of glutrin water is applied to the surface followed by a 30-min drying period by means of arcing against crossed scrap electrodes on the bottom. It is not necessary to ram in a new bottom for every relining. In 12 years of operation, only three furnace bottoms have been put in.

Extra roofs are made up and kept ready in the event of failure of the roof in operation. Mr. Jacoby mentioned the advisability of checking the roof ring, if water cooled, for leaks. Since the ring often becomes warped in service, in the straighten-

(*Continued on page* 122)

Illustration at right shows cope and drag equipment for truck wheel, made from one spoke (1-6) of wheel. Photograph by courtesy of Erie Malleable Iron Company.



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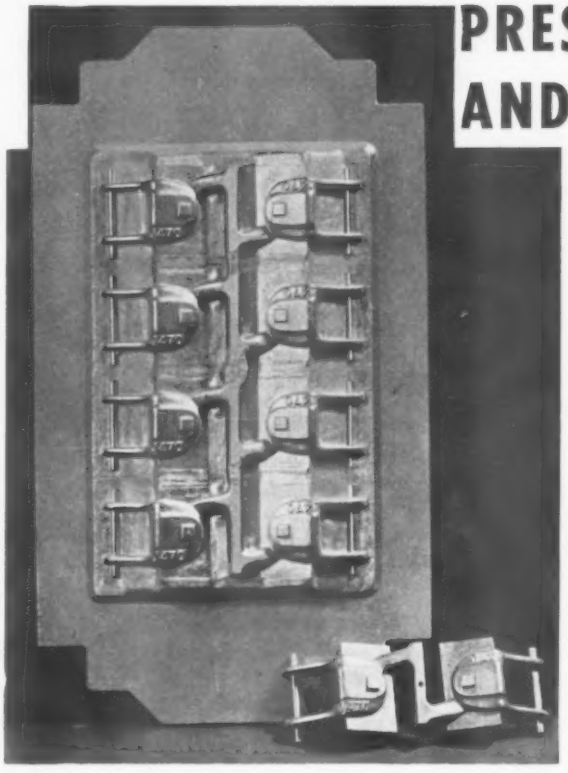

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(*Continued from page* 120)
ing process leaks often result. Special shapes are used for the roof; they require fewer bricks, less skilled labor, and less time to lay.

To minimize thermal shock to the roof during cooling, a charge is placed in the furnace and the roof swung back onto the furnace during shutdowns.

Mr. Jacoby described methods employed for lining ladles and recommended equipment for drying them. Ladles are lined with a mulled gannister mixture consisting of 30 per cent rock gannister, 30 per cent fire clay and 30 per cent coarse silica sand rammed with air hammers around a metal-covered wooden form. Their stopper rod assembly consists of fire clay sleeves the length of the rod with a coil spring between the top nut and the last sleeve on the stopper rod to allow for expansion of the clay sleeve.

Sand Studies . . .

EIGHT papers dealing with a variety of studies of core and molding sands comprised the Sand Division's program at four technical sessions. In addition, a joint session was sponsored with the Steel Division.

The opening session was presided over by H. K. Salsberg, the Borden Co., Bainbridge, N. Y. as chairman, and by E. E. Woodliff, Foundry Sand Service Engineering Co., Detroit as co-chairman. "Treatment of Bond Clays For Foundry Sand" was the title of a paper prepared by A. E. Pavlish, Kelly Island Lime & Transport Co., Cleveland, and presented by H. W. Lownie, Battelle Memorial Institute, Columbus.

Discussing treatment of base exchange reactions, the speaker pointed out that binding properties of various clays used in bonding foundry sands vary widely and are influenced by numerous addition materials. Purpose of the investigation was to modify certain properties of two clays marketed for use in synthetic molding sand. The paper reports the results of study of the effect of base exchange reactions. Phenomenon of base exchange is the replacement of bases of positive ions in or on the clay particle by other positive ions. The paper was illustrated by five extensive tables showing data on preparation of clays by base exchange reactions. Four charts showed mechanical properties of (1) sand bonded with southern bentonite, (2) with fire clay, (3) the effect of water content on mechanical properties of clays, and (4) the addition of lignin binders to clay bonded sand.

A second paper, "Phenolic Resin Core Binders," by J. E. McMillan and J. A. Wickett, Plastics Division, Monsanto Chemical Co., Springfield, Mass., and presented by Mr. McMillan, stated that the object of the laboratory and foundry evaluation work was the development of a phenolic core binder resin suitable for foundry use. In early experiments it became apparent that the resin evaluation work could be meaningful only when correlated with the effects of other components in the mix. The body of the paper details the experimental work involved in (1) establishing reproducible results in the laboratory (2) determining how these results are affected by core components and (3) correlating physical properties of core mixes with casting quality.

C. B. Jenni, General Steel Castings Corp., Eddystone, Pa., presided at the second sand session, assisted by J. H. Lowe, Wehr Steel Co., Milwaukee. Results of an investigation described in a paper, "Reproduciblity of Foundry Sand Tests," by B. H. Booth, Carpenter Bros. Inc., Milwaukee, P. C. Rosenthal, University of Wisconsin, and H. W. Dietert, Harry W. Dietert Co., Detroit, were presented by Mr. Booth.

Care Needed in Testing

The AFS Green Sand Properties Comittee sponsored the investigation, to determine if it is possible to reproduce foundry sand tests in different laboratories with reasonable accuracy. Identical samples of a prepared sand were shipped in airtight containers to members of the committee, for testing in their various laboratories. Moisture, green and dry permeability, green and dry compression, green and dry shear, deformation and toughness tests were all made on the same date. After completion of the tests compiled data were studied by the committee with the following conclusions: With the possible exception of the permeability test, common tests on green molding sand are far from foolproof. Even the relatively simple moisture test is subject to considerable error.

A tour of the various laboratories was then made by two of the committee members, to determine possible reasons for the discrepancies. Two different types of molding sands were tested in this instance, for moisture, permeability and green compressive strength, identical samples being furnished each laboratory. Conclusions reached following these tests, many of which reproduced very well, determined that improved results can be expected when proper consideration is given to sand rammer mountings, repairs and use of standardized specimen tubes. Test procedure for each test must be performed in accordance with detailed instructions. Personnel of the sand testing laboratory should receive greater attention. Sand testing equipment should receive adequate attention and its quality and design should keep pace with technical development of foundry controls.

R. G. Thorpe, Cornell University, Ithaca, N. Y., presented a progress report on the Sand Division's research project on "Properties of Steel Sands at Elevated Temperatures," prepared in co-operation with Peter E. Kyle, professor of metallurgy there, and John P. Fraser, formerly associated with the college and now corrosion engineer, Shell Development Co., Emeryville, Calif.

Study Two Sands

The report, covering the work on the project during the past year, summarized load-deformation testing and stress-strain characteristics of two synthetic sand mixtures at elevated temperatures. It also included preliminary test work completed on the scab-forming tendencies of the two mixtures. Data were presented on the stress-strain characteristics of the two synthetic steel sands as a function of furnace temperature. Limited data were given dealing with effect of loading rate on the shape of the stress-strain curve. Preliminary correlation of unconfined expansion and maximum strain in compression with the scab-forming tendencies of the two sands indicated that expansion and stress-strain data at elevated temperatures eventually may prove valuable for explanation of the fundamental causes of several common casting defects.

About 125 attended the third sand session, with B. H. Booth, Carpenter Bros. Inc., Milwaukee, presiding, assisted by J. O. Ochsner, Crouse-Hinds Co., Syracuse, N. Y. In a paper, "Flowability of Molding Sands," William H. Moore, Meehanite Metal Corp., Cleveland Hgts., O., outlined a method for measuring flowability of molding sands which distinguished two distinct properties, ventability and bondability. The average of the two is the flowability—a measurement which determines the latent ability of a sand to give uniform strength and permeability over the complete mold surface. Relationship between mold properties and sand behavior in the laboratory must be followed by a hardness tester. Relationship was also established be-

(*Continued on page* 124)

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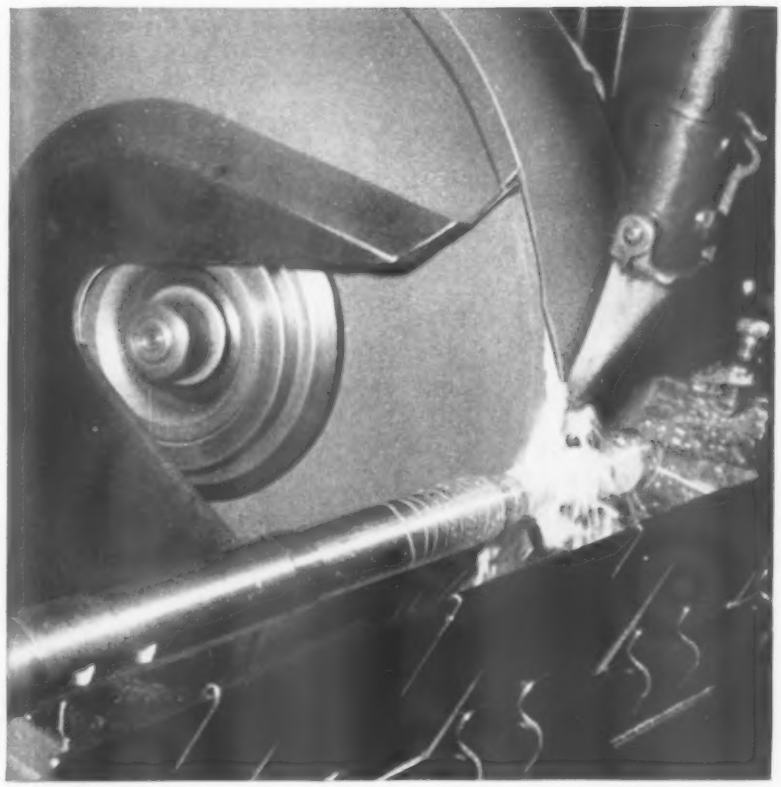

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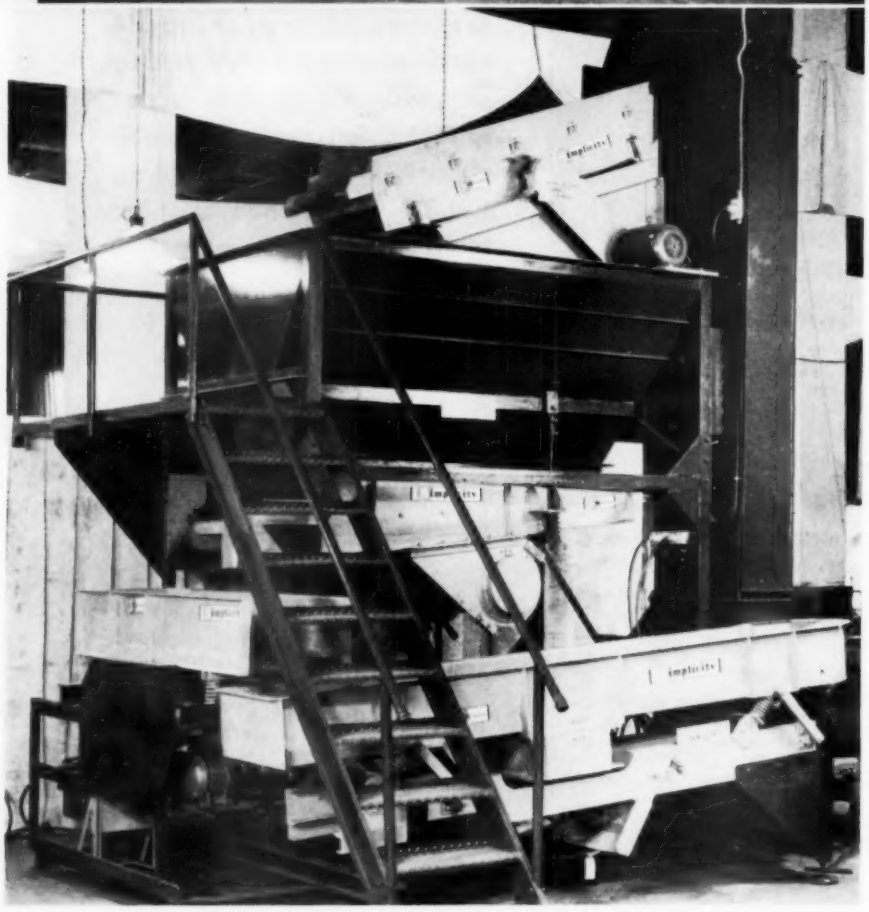

(*Continued from page* 122)

tween flowability and mold uniformity on a typical mold with a given method of ramming. Variation of flowability with moisture content indicates need for always having sand at its optimum temper point.

Typical examples of flowability control were quoted as examples, but it was stressed that exact procedure adopted depends entirely on existing circumstances. Synthetic sands usually have higher flowabilities than natural bonded sands but by careful control flowabilities of around 90 per cent are possible with the latter. Control of flowability is of practical benefit and is a means of avoiding most of the major defects associated with a sand condition.

Suggest New Method

A second paper was presented by R. P. Schauss, co-author with R. F. Baley, both foundry engineers, Illinois Clay Products Co., Joliet, Ill., and E. E. Woodliff, owner-consultant, Foundry Sand Service Engineering Co., Detroit. Their study of "Factors Affecting Molding Sand Density, Shrinkage, Expansion and Workability," was undertaken with sands bonded with five common clay type binders. Results of the investigations showed rammed density of molding sand to be affected by the type of clay bond and amount of clay substance. Included in the investigation were results of testing sands at constant density ramming. This suggested a new method of testing molding sands and provided measurement of relative energy of ramming for different types of sands and binders.

Two papers were presented at the concluding sand session, presided over by J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind., and P. E. Kyle, Cornell University. The first paper "A Study of the Effect of Various Binders and Additives on the Hot Strength of Molding Sands," prepared by R. E. Morey and G. C. Ackerlind, Naval Research Laboratory, Washington, was presented by Mr. Morey. With the aid of several elaborate slides the speaker explained a series of experiments with simplified synthetically bonded sand mixtures containing western bentonite as the primary binder, tested for hot compressive strength at temperatures from 200 to 2500° F. A reference sand mixture containing 2 per cent western bentonite and 3 per cent water was selected for comparison with mixtures containing other clays and to evaluate the ef-

(*Continued on page* 126)

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(*Continued from page* 124)
fects of secondary sand binders and other additions.

It was found that the clay used establishes the general pattern of the hot strength temperature curve. Clay binders produce relatively high hot strengths compared with other binders, especially in the prefusion range. Hot strength rose with an increase in both clay and water contents in the range studied.

Organic binders were studied as a single binder and as a secondary binder in combination with western bentonite. Secondary sand binders modify the strength of the clay binders, generally by increasing strength in the 400 to 800° F range. At higher temperatures the effect produced depends on the material. Certain materials, known as additives rather than binders, because they do not contribute to green strength, also were studied. These materials have a strong effect on hot strength over a wide range of temperatures. Additions of silica flour and iron oxide increase hot strength, while additions of wood flour decrease hot strength.

The second paper, "Effect of Moisture on Core Sand Mixtures," by O. J. Myers, Werner G. Smith Co., Minneapolis, described in intimate detail an extended series of tests on many types of core sand mixtures. In the opinion of the speaker the lack of control of core sand mixtures made from incoming wet sand is a more serious deficiency than the segregation that possibly would be associated with dried sand. The paper was designed to show lack of moisture control can be a serious factor. The study was confined to four mixtures: Sand and water; sand, water and core oil; sand, water and cereal binder; sand, water, core oil and cereal.

Results of the tests show that the densest baked core sand mixture is one where sand and core oil are the original and sole constituents. Sand mixtures containing core oil are denser than cores containing no oil. Apparently core oil is a lubricant as well as a binder. Other features figuring in the series of tests included equipment, binders, procedures, moisture additions, data tables, density, permeability, green strength, green and baked tensile strength, relationship between core tensile strength and moisture content, bakability, hardness. In conclusion, the author pointed out that although the data cannot be transferred directly into the elevated temperature condition in the mold filled with molten metal, they may serve as a foundation for future work.

At the joint sand and steel symposium, presided over by Charles Locke, Armour Research Foundation, Chicago, with C. B. Jenni, General Steel Castings Corp., Eddystone, Pa., as co-chairman, six papers were presented, dealing with "Interpretation of Sand Tests as Related to Steel Castings."

In introducing the subject for discussion, E. C. Troy, foundry sales engineer, Riverton, N. J., stated that sand testing is helpful in supplying information on proper molding sands but is not conclusive. Too often data are collected and interpreted and then not used. He went on to say that the purpose of sand study is to correlate chemical and physical properties of sand with casting quality. Sand compounding is one of compromising its various properties to obtain the desired result.

The first of two papers on room temperature testing was presented by J. H. Lowe, Wehr Steel Co., Milwaukee. Mr. Lowe emphasized the need for quality control so that casting quality can be correlated with sand properties. He recommended analyzing scrap reports for rejects due to sand and then checking back to the sand test and sand handling procedure. He reasoned that when sand is under control, casting quality also is under control.

In his opinion, screen analysis is the most useful test for preventing casting defects due to sand. His experience indicates that a four-grain sand gives better casting uniformity than a many-grain sand.

Collect and Correlate Data

W. J. Downey, Burnside Steel Foundry Co., Chicago, presented the second paper on room-temperature testing of sand. He stressed statistical control of green sand properties and stated that jobbing shops have a special need for sand control in furnishing universal sand for all types of jobs handled. Such control is accomplished by collecting daily sand data and correlating it with castings produced. Sand, then, can be varied and the effect on castings observed until the correct fromulation is obtained.

P. E. Kyle, Cornell University, Ithaca, N. Y., presented the first of four papers on high-temperature sand testing. He described testing procedures in the high temperature range with the use of a dilatometer. He has found that the ability of sand to withstand the strains exerted by metal in the mold cavity increases as temperature increases.

In the second paper R. H. Jacoby, Key Co., East St. Louis, Ill., described tests with wood flour additions to the sand. Hot strength, expansion and contraction characteristics were observed. One of the wood flours gave better results than the others, indicating a difference in flours, and also was better than sand with no wood flour. It also was shown that a bentonite mixture has greater deformation than silica flour mix.

The third paper, by H. W. Meyer, General Steel Castings Corp., Granite City, Ill., dealt with expansion tests. These tests were conducted without pouring metal, but at 2500° F which simulated mold temperatures

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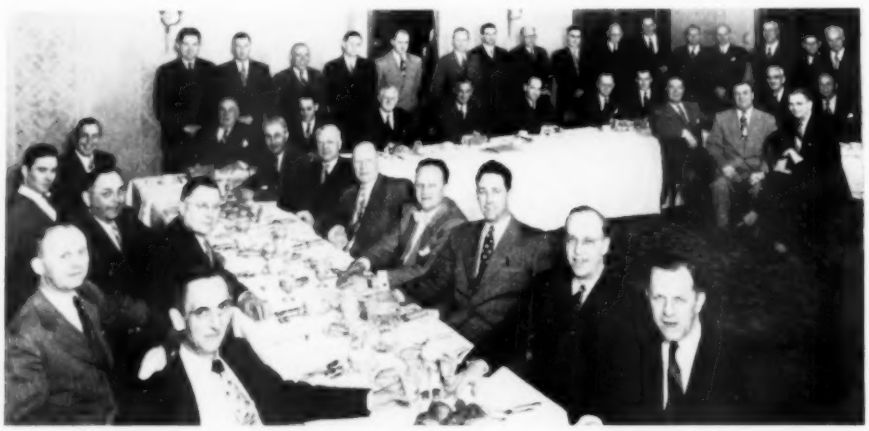

MANAGEMENT MEETING: Forty-one foundry operators met at the Schroeder Hotel, Milwaukee, Mar. 29, to discuss management problems of the foundry industry. Harry E. Ladwig, Allis-Chalmers Mfg. Co., Milwaukee, and president of the National Foundry Association, presided. Legislative affairs and educational activities of the association were outlined by Leroy E. Roark, executive vice president. Victor M. Harding, regional counsel for the association, discussed legal matters confronting the industry

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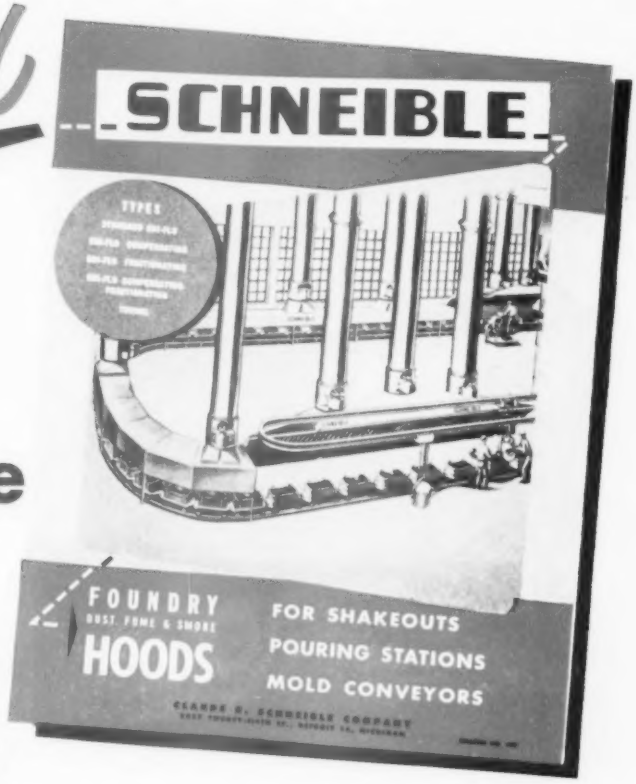

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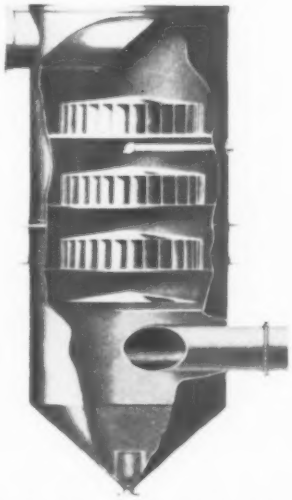

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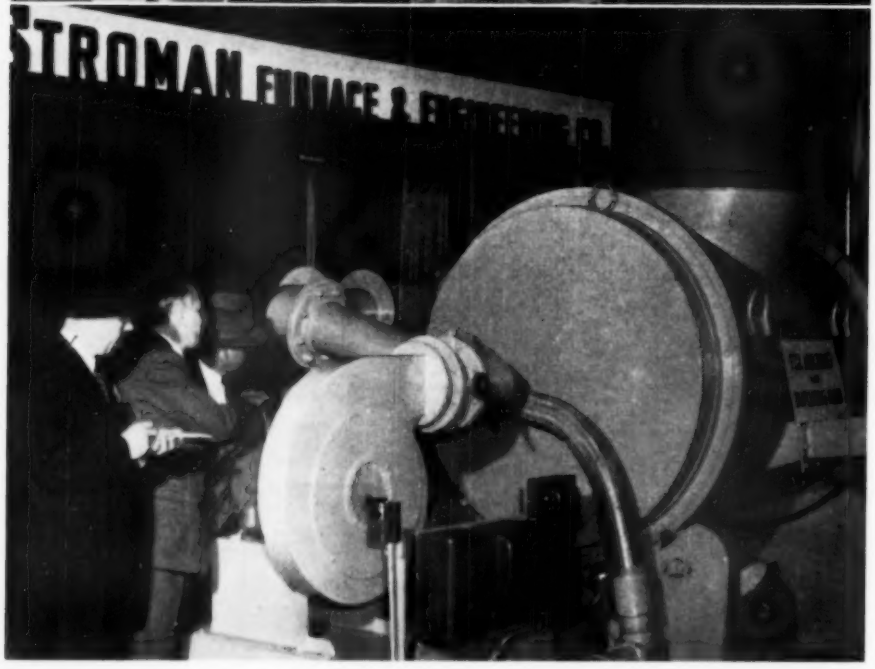

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achieved in actual foundry practice. Mr. Meyer pointed out that test procedures must be governed by casting design, size and weight of casting, personnel conducting the tests, foundry practice, molding characteristics, and other information.

He stated that casting defects attributed to sand are due to the thin layer of sand next to the casting. Back-up sand has little effect. His testing work has shown that room temperature properties differ from elevated temperature properties, affecting to a great degree casting quality.

Concluding paper was by J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind. It covered the relationship of elevated test data to hot tears. According to Mr. Rassenfoss, satisfactory sands must be thermally stable and must resist chemical and physical effects of metal entering the mold. Cores must not restrict flow of metal to a greater extent than mold strength.

The speaker concluded by saying that as the section size of a casting increases, hot tears decrease, with a given sand mixture.

Nonferrous Shop Course

EVENING shop courses were expanded during the convention by the addition of a nonferrous series sponsored by the Brass and Bronze Division. The first meeting, devoted to "Fuel Melting," had J. L. Stroman, Stroman Furnace & Engineering Co., Franklin Park, Ill., presiding, with Martin G. Dietl, Crane Co., Chicago, discussion leader.

It was pointed out that the many factors involved in melting preclude the claim that any one type of furnace or fuel is superior under all conditions. These factors include production requirements, nature of alloys used, size and type of charge, quality of scrap and the sort of working conditions sought.

The speaker stated brass and bronze may be melted in a primitive type furnace—for example, an empty oil drum lined with refractory material—but the practice is not economical irrespective of the fuel employed. For satisfactory operation several types of modern high-efficiency furnace are available. Manufacturers of these furnaces have had many years experience and can offer valuable advice and instruction. The speaker devoted some time to detailed description of gas burners, their installation and application. A single burner will serve satisfactorily on

(*Continued on page* 131)

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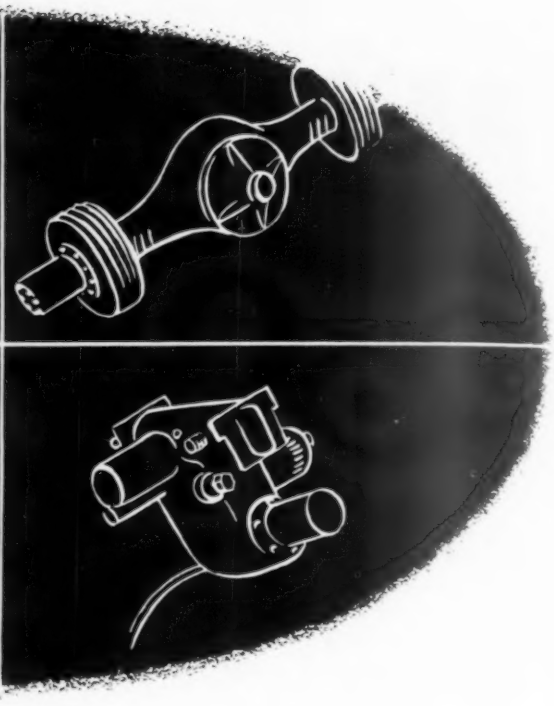

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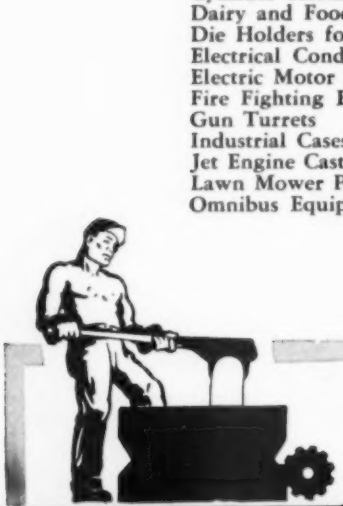

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(*Continued from page* 128)

crucibles up to No. 100. For larger crucibles it is advisable to use two burners. All lining materials serve satisfactorily, but they should not be abused. A checkup and minor repairs every week-end usually are sufficient.

Attention was drawn to the necessity for keeping the slag hole open. A slag build-up interferes with melting capacity of the furnace. Flame from the furnace cover opening supplies information to the melter, provided he can interpret the symptoms correctly. The speaker did not approve the practice of heating part of the charge over the cover flame; nonferrous metal is very susceptible to gas absorption.

A statement that a little silicon carbide or silica sand sprinkled on the pedestal prevents the crucible from sticking was amplified by a member from the floor who claimed nothing equals a handful of charcoal for this purpose.

Quality Has Decreased

In a brief description of various types of furnaces, the speaker referred to the fact that present day fuel oils are not as satisfactory as oils used for melting purpose several years ago. In addition to showing lower heating efficiency, the poorer grades of oil increase the tendency to gas absorption in the metal. Main objection to sold-fuel-fired furnaces is that they are hot and dirty. Men do not like to work on them. Also the labor cost is high.

A question that elicited spirited comment centered on the use of wet or even damp material in the charge. Claim was advanced that any moisture in the charge creates water vapor which affects the metal adversely. According to another claim, any dampness in the charge is expelled before the metal reaches melting temperature and therefore is not a factor.

Second session of the Nonferrous Shop Course was presided over by Bruce W. Schafer, Kuhlman Electric Co., Bay City, Mich., and Martin G. Dietl, was discussion leader. "Electric Furnace Melting" was the topic.

The low-frequency induction, electric resistance and indirect arc were the types of melting units around which discussion centered. Mr. Dietl described and outlined his experience with a 60 KW Ajax-Wyatt low-frequency induction unit in which the charge functions as the secondary. This furnace will melt 1000 pounds of brass in 1¼ hours. It has a 3 x 1¼-inch opening in the refractory slot block. Should this block fail, the metal will leak out. The furnace is lined with mullite-type cement. It is operated 8 hours per day. It would be better, Mr. Dietl explained, if it could be utilized 24 hours per day, for on this basis it would be more efficient. A disadvantage of this type of furnace is that it does not lend itself well to frequent changing of alloys.

The electric resistance type of furnace uses carbon electrodes and is a rocking unit, with a zircon or mullite lining.

Gray Iron Castings . . .

AN ANALYSIS of ASTM Standard A-48 arbitration bars for gray cast iron vs. Y-shaped test blocks designed to provide sound test bars in a wider range of section sizes (¼ to 3 in.) indicates the latter provide four times the range of cooling rates and, consequently, presents a better evaluation of mechanical properties. Results of tests on this subject were presented at the first of three gray iron sessions in a paper entitled "Improved Test Bars for Standard and Ductile Grades of Cast Iron," jointly prepared by Richard A. Flinn and R. Wayne Kraft, metallurgical department, American Brake Shoe Co., Mahwah, N. J. A. P. Gagnebin, International Nickel Co., Bayonne, N. J., presided at this session; W. B. McFerrin, Haynes Stellite Division, Kokomo, Ind., was co-chairman.

Mr. Flinn pointed out that shrinkage and narrow range of cooling rates are the two principal difficulties in using arbitration bars. Recent tests have shown all the arbitration bars and none of the Y-blocks exhibited shrinkage in the test sections. This results from a lower thermal gradient 3 to 9°F per in. in the arbitration bars compared with 38 to 61° F per in. in the Y-blocks. The difference in mechanical properties was severe in pearlitic and ferritic ductile irons and negligible in Class 50 and 30 irons. The shrinkage effect could be shown, however, in the lower strength materials by 0.505-in. diameter specimens cut from the center of the larger arbitration bars.

It was also noted that the transverse bars machined from Y-blocks provide more accurate and reproducible data than the sand cast bars because of revision of the test method and the better specimen condition. The authors recommended the Y-block tests for consideration as an alternate standard.

In discussion, Tom E. Eagan, chief metallurgist, Cooper-Bessemer Corp., Grove City, Pa., commented that his experience with Y-blocks to date indicates it takes more time and expense to prepare the test piece, for it must be cut off by sawing and machined from rectangular or square bar.

The report of the AFS Cupola Research Committee, presented by Richard G. McElwee, Vanadium Corp. of America, Detroit, indicated continued progress in the development of a quick, inexpensive technique for testing coke and in other programs, including slag studies in cupola operation. The committee plans to add another research program covering cupola design, prompted by advanced thinking in desulphurization originating among European foundries. Mr. McElwee also announced that the second revised edition of the Cupola handbook will be published later this year.

With Dr. A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N. J., and Charles O. Burgess, Gray Iron Founders' Society, Cleveland, presiding, two papers were presented at the second gray iron session. The first paper, "Composition and Properties of Gray Iron," by Dr. Richard Schneidewind, University of Michigan, Ann Arbor, Mich., and Richard G. McElwee, was summarized by Dr. Schneidewind.

Shows Limiting Compositions

The authors re-evaluated the Maurer diagram to develop a mathematical formula to show the limiting compositions with respect to carbon and silicon which will cast white. That takes the form: $C = -2.85 \log Si - 1.6 \log D + 2.703$, where D is the diameter of the bar, and which can be translated into other shapes.

The authors also suggested an equation for predicting the probable tensile strength of gray irons cast in sand which takes the form: $T = 10{,}000\ (11.68 - 2\ C.E. - 2.3 \log D_e)$, where C.E. is the carbon equivalent equal to $C + 1/3\ Si + \frac{1}{4}\ P$, and D_e is the equivalent diameter of the casting in inches. When alloyed the strength as computed by the equation is multiplied successively by factors, one factor for each alloy. Indicated factors include 0.45 for Mo, 0.5 for V, 0.05 for Ni, 0.4 for Cr, 0.5 for Cu, and 0.1 for Mn over 0.7 per cent. The authors point out that such effects as inoculation, superheat, variations in raw materials and foundry practice do not permit exact predictions by use of the equations, but they appear to be within plus or minus 10 or 15 per cent.

The basic-lined cupola was the subject of the second paper, presented by Sam F. Carter, American Cast Iron Pipe Co., Birmingham. Observations of over 100 heats showed that

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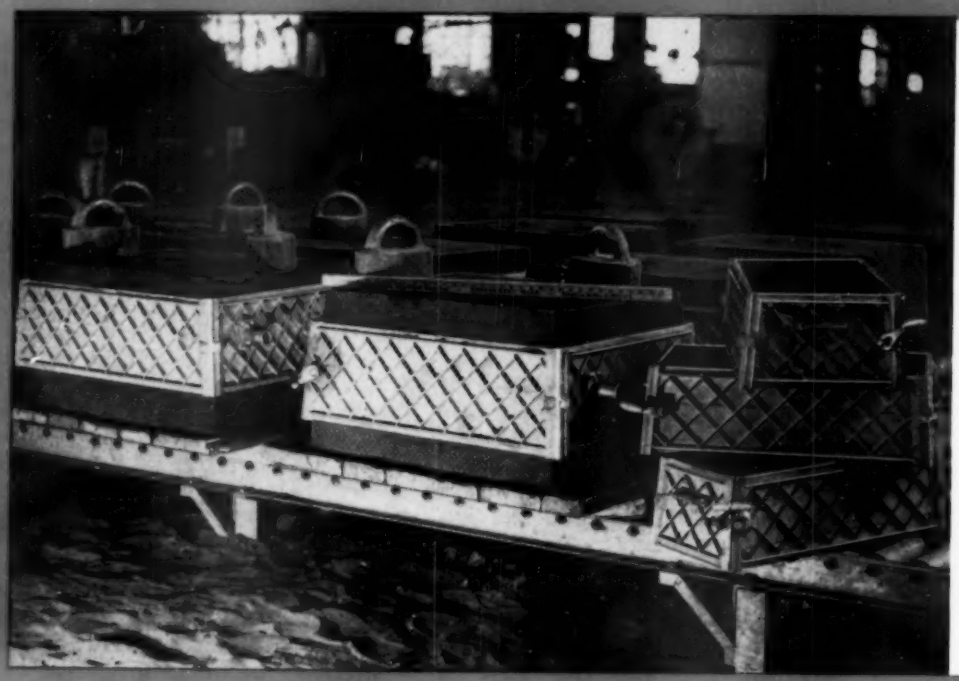

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(*Continued from page* 131)

magnesite brick are practical as the lining. With a basic lining either sulphur or phosphorus may be removed from iron melted in the cupola. However, when phosphorus is removed the silicon is reduced, and temperatures are rather low. For removal of phosphorus oxidizing conditions must exist in the cupola. In sulphur reduction the conditions are reducing, and from 0.020 to 0.040 per cent lower sulphur pickups are obtained at usual sulphur levels compared with melting in the normal lined cupola which may increase to 0.100 per cent with high-sulphur levels.

Addition of calcium carbide to the coke bed gave increased desulphurization as indicated by the following: Removal of 0.187 per cent S from an 0.287 per cent S all-scrap charge using 5 per cent carbide; an 0.016 per cent S final from an 0.134 per cent S all-scrap charge with 6 per cent carbide; and an 0.009 per cent S final from an all pig iron charge with 6 per cent carbide. Use of calcium carbide also was found to increase the temperature of the metal, and that heat producing ability would permit reducing the coke to one-third normal with the same melting temperature, but with the output increased 40 per cent.

Give Property Relationships

Concluding session on gray iron was held Friday morning with Fred J. Walls, International Nickel Co. Inc., Detroit, and George A. Timmons, Climax Molybdenum Co., Detroit, presiding. First paper on "Correlation of Properties of Gray Iron," by Richard G. McElwee and Dr. Richard Schneidewind, was discussed by Mr. McElwee. A continuation of the report given by these authors the previous session, this paper presented a number of relationships in gray iron properties by means of tables and charts. Included were data on tensile strength and transverse strength, tensile strength and compressive strength and compressive strength, and tensile strength and modulus of elasticity in tension.

Mr. McElwee explained that the information presented had limitations, but if used with those in mind, it was possible for the foundryman to predict gray iron properties within reasonable limits. One interesting feature of the work was the development of a scale-chart showing the mechanical properties of unalloyed gray iron from the carbon equivalent.

The second paper at this session dealt with "Some Tests on Relaxation of Cast Iron," jointly prepared

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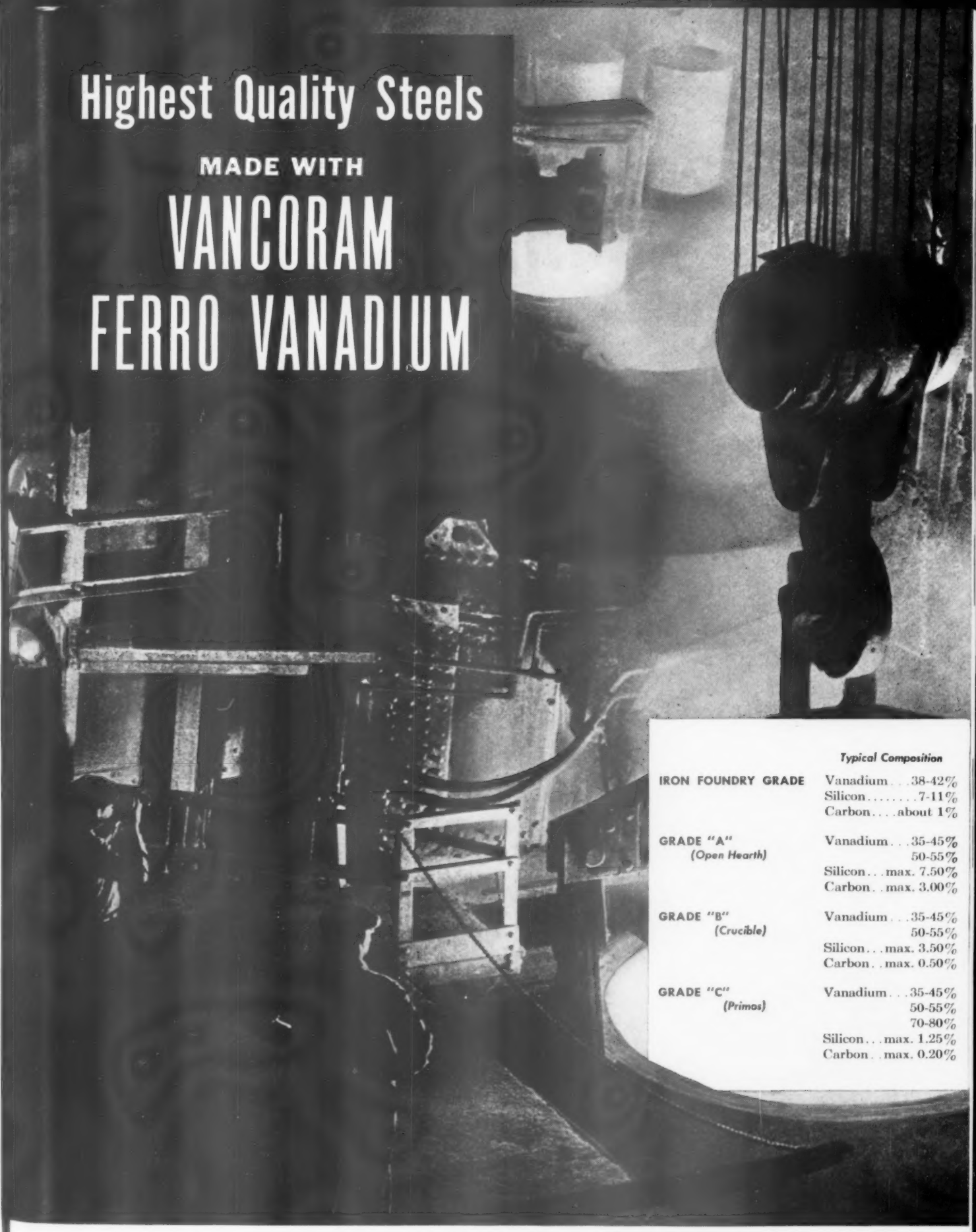

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GRADE "A" *(Open Hearth)*	Vanadium . . . 35-45% 50-55% Silicon . . . max. 7.50% Carbon . . . max. 3.00%
GRADE "B" *(Crucible)*	Vanadium . . . 35-45% 50-55% Silicon . . . max. 3.50% Carbon . . . max. 0.50%
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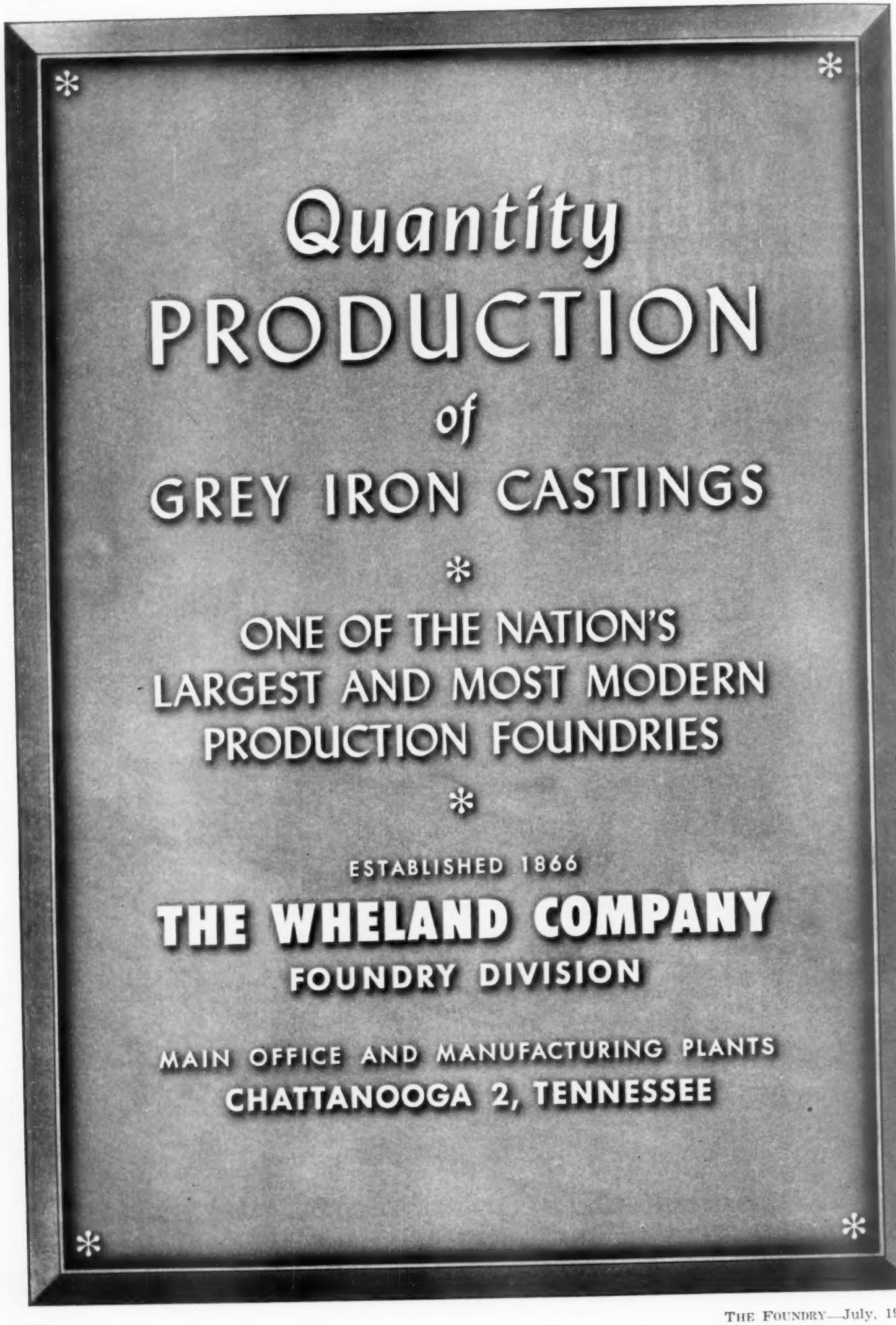
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(*Continued from page* 134)

by V. T. Malcolm, director of research, and S. Low, research engineer, Chapman Valve Mfg. Co., Indian Orchard, Mass. The relaxation test described was a constant strain test in which the sum of the elastic and plastic strain is held constant. An extensometer is arranged in such a manner as to permit the stress to decrease as the strain attempts to increase. A recording pressure gage, connected to the load tank, continuously records head of water versus time. Since head of water may be directly converted to stress in the bar, an autographic record of residual stress versus time is obtained.

Fred J. Walls, presided; T. D. Parker, Climax Molybdenum Co., Detroit, was co-chairman at this session.

The roundtable luncheon sponsored by the Gray Iron Division, presided over by F. S. Brewster, Harry W. Dietert Co., Detroit, and R. A. Clark, Electro Metallurgical Division, Union Carbide & Carbon Co., Detroit, considered the subject of the effect of mold materials on metal shrinkage. The discussion, led by C. C. Sigerfoos, Michigan State College, East Lansing, Mich., C. A. Sanders, American Colloid Co., Chicago, and W. F. Bohm, Buick Motor Division, Flint, Mich., was confined to gray iron.

Plant Equipment . . .

TOOLS and facilities employed in the foundry cleaning room were described extensively at the two technical sessions sponsored by the Plant and Plant Equipment Committee.

The first session had James Thomson, Continental Foundry & Machine Co., East Chicago, Ind., as chairman and R. J. Wolf, Stone & Webster Engineering Corp., Boston, as vice chairman. Discussing "Oxygen Cutting Processes in Steel Foundries," R. S. Babcock, Linde Air Products Co., Newark, N. J., described latest developments in cutting apparatus for removing gates, risers and surface defects, and in scarfing equipment for pad reduction. This included powder-cutting and powder-washing techniques; the latter is a relatively new process for cleaning surfaces of sand-incrusted castings.

"Bandsawing in Foundries," by G. H. Sheppard, the DoAll Co., Des Plaines, Ill., detailed friction sawing and low-speed sawing of ferrous castings, and both low and high-speed sawing of nonferrous castings. Recommendations were made for cutting speeds and processes for different types of cast materials, surface finish required and tolerances sought.

"Selection and Application of Cleaning Equipment," a paper by Stanley F. Krzeszewski, American Wheelabrator & Equipment Corp., Mishawaka, Ind., described advantages and limitations of different types of cleaning units and abrasives. These included airless blast machines of the tumbling and table types, tumblers, sand blast rooms, wet blasting units and pickling equipment.

Mr. Thomson also presided at the second session, with Harold W. Johnson, Wells Mfg. Co., Skokie, Ill., co-chairman. Boyd W. Work, the Carborundum Co., Niagara Falls, N. Y., discussed use of snagging equipment and pointed out these means for cost savings in rough grinding work: Using correct type and size of equipment with ample power; standardizing and classifying the work and selecting abrasive specifications to match; avoiding crane service delay and facilitating work handling; educating supervision and operators on factors affecting costs; giving the same close study to the cleaning room as is given to melting, molding or patternmaking departments. In conclusion, Mr. Work observed that it usually is cheaper to leave unnecessary stock off a casting when it is made than to remove it later.

Repair Welding Discussed

Procedures for salvaging defective ferrous and nonferrous castings by welding were described by B. E. Bellew, Air Reduction Sales Co., New York. He explained that steady progress is being made in welding methods, and no established operation, however satisfactory, should remain static for too long. For example, if the inert-gas-shielded-arc process could be applied to mild steels as successfully as it is to stainless, it could revolutionize foundry thinking about welding steel castings.

Use of portable chippers and pneumatic grinders in foundry cleaning rooms was discussed by A. W. Burton, Ingersoll-Rand Co., New York. His paper was prepared by A. G. Ringer of that company. In describing chipping hammer applications, it was pointed out that cutting efficiency can be reduced 25 per cent by 0.012-in. wear on the piston nose diameter; consequently the latter should be checked regularly. Different types of portable air grinders were described and the recommendations made that the size selected for a particular job should have a speed corresponding to the size wheel to be used. Importance of maintaining proper wheel diameter and air pressure for most efficient grinding was stressed.

Methods of transporting material in the cleaning room were discussed by R. J. Wolf, Stone & Webster Engineering Corp., Boston, in a paper prepared by him and N. L. Smith, Link-Belt Co., New York. These methods included use of belt, apron, oscillating, trolley and roller conveyors, monorails, cranes and lift trucks. Selection of the most suitable type of equipment depends on whether or not straight line operations can be obtained between two points and whether or not operations are uniform; however, no hard and fast rule for choice of handling units can be drawn.

Steel Castings . . .

FOUR sessions and a roundtable luncheon were sponsored by the Steel Division as its primary contribution to the technical program. It also co-operated with the Sand Division in a joint meeting and with the Gray Iron Division in a second joint session.

At the opening session, Charles Briggs, Steel Founders' Society of America, Cleveland, presided, and Richard E. Kerr, Pettibone Mulliken Corp., Chicago, was co-chairman. Three papers highlighted the agenda.

"Nature of Mold Cavity Gases," the first paper, was authored by Charles Locke, supervisor, foundry process research, and Richard L. Ashbrook, assistant metallurgist, Armour Research Foundation of Illinois Institute of Technology, Chicago, and presented by the former. Variables affecting pressures in a mold cavity during pouring were found to increase directly with increase of pouring rate and inversely with permeability. Cereal content of the molding sand had an inappreciable effect on the mold pressure. Intensity of the pressures observed were all insufficient to have an appreciable effect on filling of a mold.

According to the authors, permeability of a mold subjected only to radiant heat during casting is approximately the same as when the same mold is tested at room temperature. Chemical analyses of mold cavity gases show that hydrogen is present in both dry and green sand molds but is greater in the latter. Other gases are CO, CO_2, N_2, O_2 and paraffins.

No tests were performed to determine possible effects of the gases on the steel. However, some conjectures can be made, Mr. Locke said. It has been reported that castings poured in green sand molds are more apt to have porosity than castings poured in dry sand molds. The adverse effect

of green sands was attributed to atomic hydrogen from decomposition of water in the sand. The research showed that hydrogen levels for dry sand molds could be as high as 50 per cent of the hydrogen levels in green sand molds.

Two possible explanations for this lesser effect of dry molds were offered: 1. The hydrogen level is lower than in green sand molds; and 2. cereal and oil binders decompose directly to H_2 without formations of atomic hydrogen.

Effect of ferrostatic pressure on metal penetration of steel sand cores was discussed in the second paper, "An Investigation of Metal Penetration in Steel Sand Cores", by S. L. Gertsman and A. E. Murton, physical metallurgist and metallurgist, respectively, physical metallurgy division, Bureau of Mines, Ottawa, Can., and presented by the former.

Metal head of the standard casting was varied and relative importance of different sand variables was studied. Cores made with 100 per cent silica flour resisted penetration under the highest ferrostatic pressure used in the experiments. In castings with a high metal head, average fineness to prevent penetration should be less than 0.075 mm for a subangular sand. No significant difference in penetration of wide and narrow range sands was observed when average screen size was the same.

In closing Mr. Gerstman warned it was not intended to conclude that ferrostatic pressure is sole cause for metal penetration. The investigation, however, does introduce an effective method of testing metal penetration. Increasing the head of the standard casting increases severity of the test.

In the closing paper, Robert E. Savage, metallurgist, International Nickel Co. Inc., New York, and Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., reported on "A Thermodynamic Study on Pinhole Formation in Steel Castings." Pinholes, they stated, are among the more serious surface imperfections suffered by steel castings, particularly those made in green sand molds.

In 1941, Sims and Zapffe solved the problem by using aluminum as a deoxidant. Being soluble in iron, an excess of aluminum could be added as insurance against gas pickup during or after pouring. Unfortunately, carbon-molybdenum steel castings used for high-temperature pressure service began to fail by graphitization at welded joints. Aluminum was found to promote graphitization and was barred by specifications from use in making this type of steel. To date, no suitable substitute has been found. In one plant alone, repair of pinholes costs $200,000 per year, thus the problem is acute.

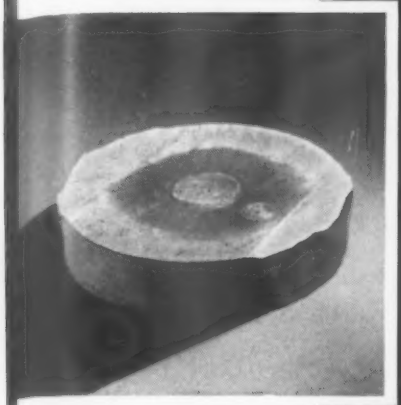
Hydrogen not Cause

Research reported in the current paper renewed the investigation with a thermodynamic approach to the problem. This study of pinhole formation indicated: 1. That hydrogen dissolved in steel does not create enough gas pressure to form cavities; 2. the hydrogen-oxygen reaction with formation of water vapor does not occur; 3. most probable cause of pinholes is carbon monoxide gas; 4. carbon monoxide gas is formed by reaction of the carbon of the steel with iron oxide formed at the mold-metal interface; and 5. no experimental proof of the thermodynamic indications is offered; plant and laboratory tests have only recently been initiated. It is hoped new interest will develop a way to eliminate pinholes from castings made of metal which cannot be treated with aluminum.

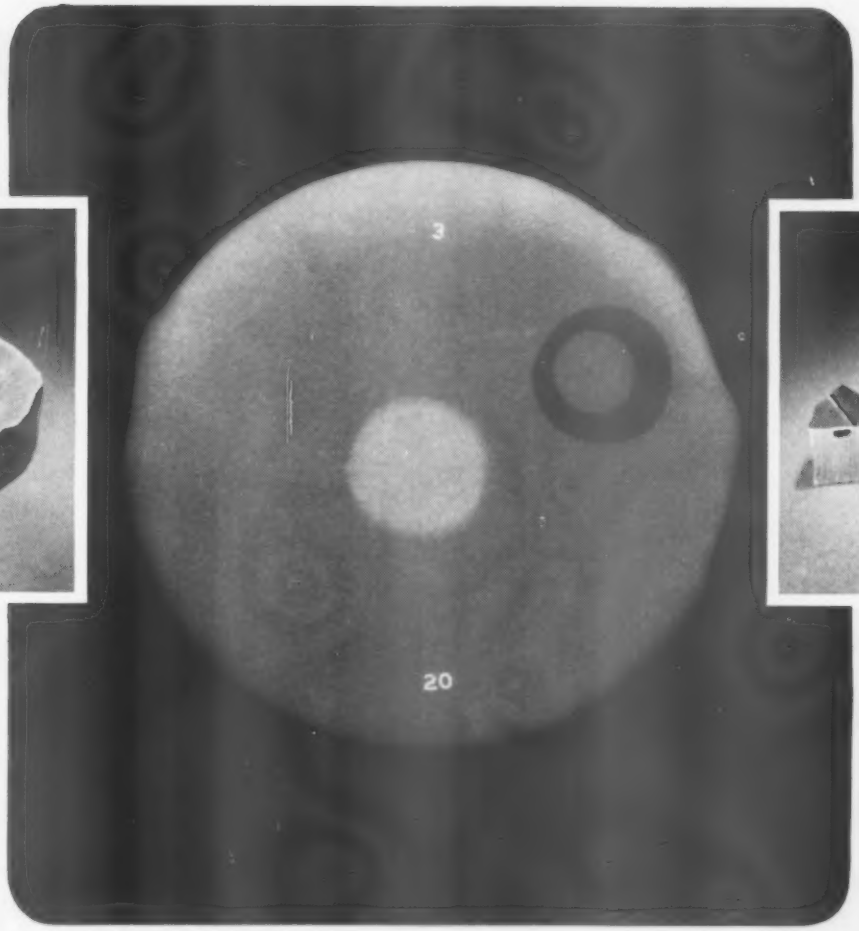
This paper attracted several written discussions. In one, C. E. Sims, Battelle Memorial Institute, Columbus, O., asserted there is some argument over the authors' fifth conclusion. Hydrogen, he pointed out, is more likely the cause of pinholes than carbon monoxide, thermodynamics notwithstanding.

Two papers comprised the program for the second steel session. R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, presided, and D. C. Zuege, Sivyer Steel Casting Co., Milwaukee, was co-chairman.

(*Continued on page* 141)



Aluminum alloy casting 2¼ x 11¼" for aircraft accessory part.



Radiograph which revealed defect in casting.

Section reveals hole detected by radiography.

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AFTER machining, this aluminum alloy casting was to be an important part in an aircraft accessory, vital to high-altitude flying. The finished part was needed quickly by the customer. Design specifications demanded high quality.

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Cases like this show how more and more foundries are able to release only sound castings. Perhaps even more important, radiography is showing how to make consistently sound castings, by picturing the internal effects of changes in gating, venting, chilling, pouring temperature, and other variables.

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(*Continued from page* 138)

In the first paper, G. A. Lillieqvist, research director, American Steel Foundries, East Chicago, Ind., dealt with "Influence of Temperature on Fluidity and Surface Appearance of Steel Castings." Through work of other investigators and his own company's experiences, it has become apparent, he emphasized, that accurate control of liquid steel temperatures is of prime importance.

After pointing out that the portable optical pyrometer commonly used during tapping and pouring of a heat has definite limitations, the speaker discussed the three types of temperature equipment used in the investigation: the platinum-platinum 10 per cent rhodium immersion thermocouple, the Rayotube and the photoelectronic equipment. Information obtained through their use showed effect of various melting units on fluidity of steel at comparable temperatures.

Demonstrates Economics

In discussion, R. H. Jacoby, Key Co., East St. Louis, Ill., commented that the paper casts suspicion on the older methods of temperature measurement, demonstrates the economics of temperature measurement and correlates temperature measurement and fluidity. His company, he volunteered, makes the melter responsible for temperature control; this procedure is believed to be unusual but it has worked well for two years. Company also makes use of the fluidity spiral and considers it a valuable tool for the average small foundry. Mr. Lillieqvist commented that with the immersion pyrometer a temperature difference of 200 degrees has been found, whereas the optical pyrometer would show a difference of 15 to 20 degrees only.

"Steel Quality as Related to Test Bar Fractures" was subject of the second paper submitted by H. H. Johnson and G. A. Fisher, chief metallurgist and quality control engineer, respectively, National Malleable & Steel Castings Co., Sharon, Pa., and presented by the former.

Primary purpose of the paper was to emphasize importance of the character of the test bar fractures (especially for normalized and normalized and tempered steel) as an indication of quality of the steel represented by them and to employ statistical methods to demonstrate the differences in quality levels.

Two general causes of noncupped fractures were studied, one related to effect of gases in the steel (principally hydrogen) and which can be benefited by suitable heat treatment, and the other, due, perhaps, to inclusions in the steel is not benefited by heat treatment.

Effects of the inclusion form are indicated especially by: (1) Period of overdeoxidation and attendant reduction in silicon into the metal, resulting in an increase in noncupped fractures; (2) period of increased oxidation caused by an intentional change in the level of the melt-in carbon, resulting in a decrease in the occurrence of noncupped fractures; and (3) period of intentional changes in the Mn/S ratio resulting in a marked decrease in occurrence of noncupped fractures.

Third steel session also featured two papers. L. H. Hahn, Sivyer Steel Casting Co., Chicago, presided and J. K. McBroom, Stainless Foundry & Engineering Co., Milwaukee, was co-chairman.

Sam F. Carter, assistant melting superintendent, American Cast Iron Pipe Co., Birmingham, Ala., contributed the first paper on "Manganese Recovery in Acid Electric Steelmaking." Purpose of the investigation was to study factors affecting manganese recovery by correlating concurrent metal and slag analysis before and after manganese addition.

Conditions investigated were single slag heats of normal manganese content, single slag heats of higher Mn content, double slags low in FeO, high in lime, and high in MnO. Factors studied were slag compositon, desired metal analysis, temperature, time, slag fluidity, quantity of slag and ladle additions.

Questions Conclusions

In discussion, H. H. Johnson, National Malleable & Steel Castings Co., Sharon, Pa., questioned whether conclusions arrived at by the author were justified on the basis of the evidence presented. It was pointed out that the speaker had considered only 6 of 26 heats. In reply, Mr. Carter expressed belief that these heats were those illustrating the conditions on which light was being sought.

Second paper, "Metal Composition Tests for the Steel Melter," was authored by H. H. Fairfield, chief metallurgist, H. F. Graham, assistant metallurgist, and A. E. McMeekin, melting supervisor, William Kennedy & Sons Ltd., Owen Sound, Ont., and was presented by the former.

Although a number of different procedures may be used to determine metal composition, the authors demonstrated how hardenability properties of steel may be used for rapid test procedures. In the authors' plant, melters determine bath analysis in less than 2 minutes.

Since surface finish of castings is second only in importance to satisfactory service performance, considerable interest was shown in a paper on "Fayalite Reaction in Sand Molds Used for Making Steel Castings," prepared by Robert E. Savage, metallurgist, International Nickel Co. Inc., New York, and Howard F. Taylor, Massachusetts Institute of Technology. It was presented at the third steel session.

In their joint study fayalite was found by x-ray diffraction analysis to be the only product formed by the interface reaction between the steel casting and the silica sand mold. Fayalite is formed by oxidation of the iron of the steel and subsequent reactions of this oxide with silica. Interface reactions occur only in oxidizing atmospheres. One laboratory method used for studying interface behavior consisted of a pin embedded in a sand test cylinder, with the pin heated to melting by induction.

Two Controls Available

It was emphasized by Mr. Savage that work done to date on mold-metal interface reactions is only a small beginning toward the goal of isolating specific causes of various surface defects in steel castings and establishing required remedy.

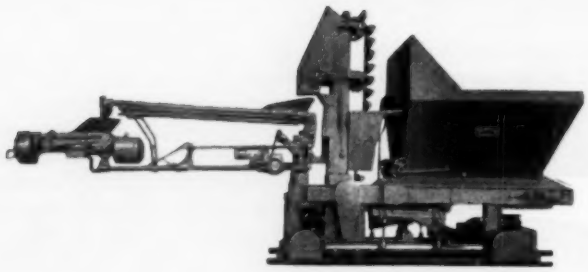
A prepared discussion of the paper by H. B. Myers, technical director, Roll Manufacturers Institute, Pittsburgh, stated there appear to be two ways to arrive at a smooth sand-free surface on steel castings: (1) To exclude oxygen from the mold atmosphere; (2) To control the fayalite reaction so that just enough forms to cause a fragile, easily removed sinter-layer. Mr. Myers mentioned these factors in considering the problem of adhering sand:

1. Composition of the metal (per cent and activity of easily oxidizable elements) and pouring temperature.
2. Design of casting in respect to section size, re-entrant angles and pockets, and gating and length of metal run.
3. Compositions and chemical properties of various constituents of mold materials, including grain sizes, also heat conductivities and thermal capacities of the various constituents.

These factors are somewhat interrelated, in that they govern the initial temperature, time at temperature, and chemical reactions which take place. He concluded that perhaps a balance exists between these factors where adhering sand no longer occurs.

In his paper dealing with "Relation of Thermal Gradients to the

(*Continued on page* 144)



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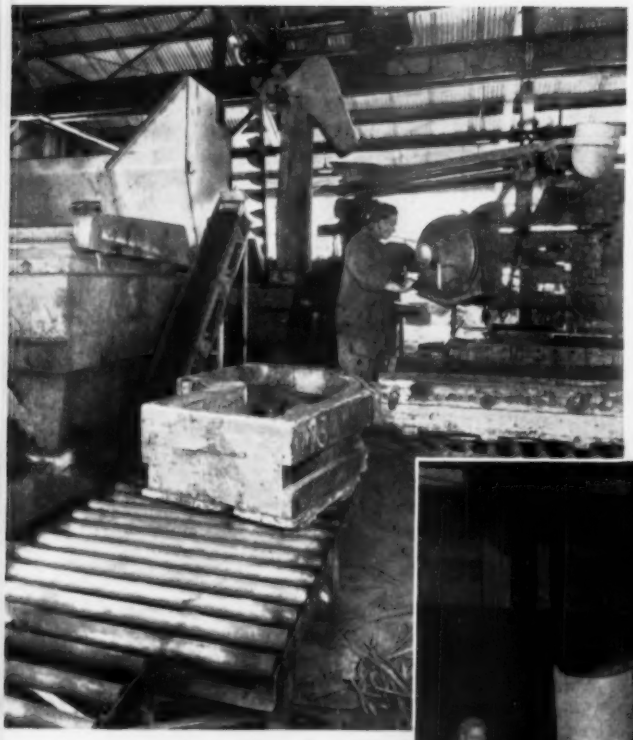
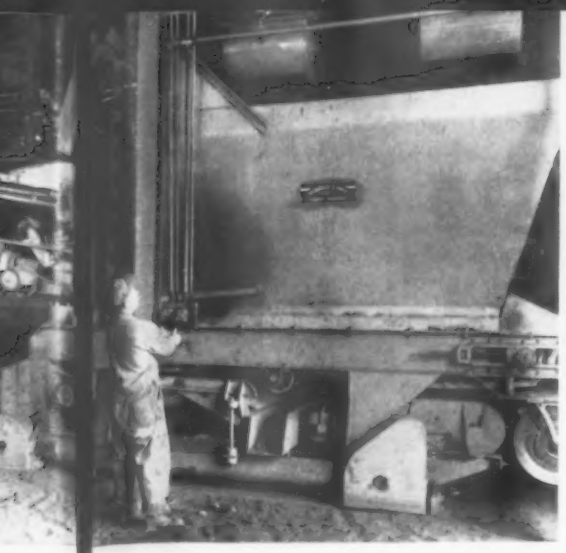


The "slinger" ramming large cores on a roller conveyor. Core sand is dumped into the floor chute and carried by inclined belt to the Sandslinger's bucket elevator. This arrangement makes it unnecessary to load the tank with core sand when cores are rammed and permits the "slinger" to do "double duty" without loss of time.

A pit mold for a 30,000 lb. crossrail is rammed. The Sandslinger rams this 8' x 30' mold in a fraction of the time required by any other method.

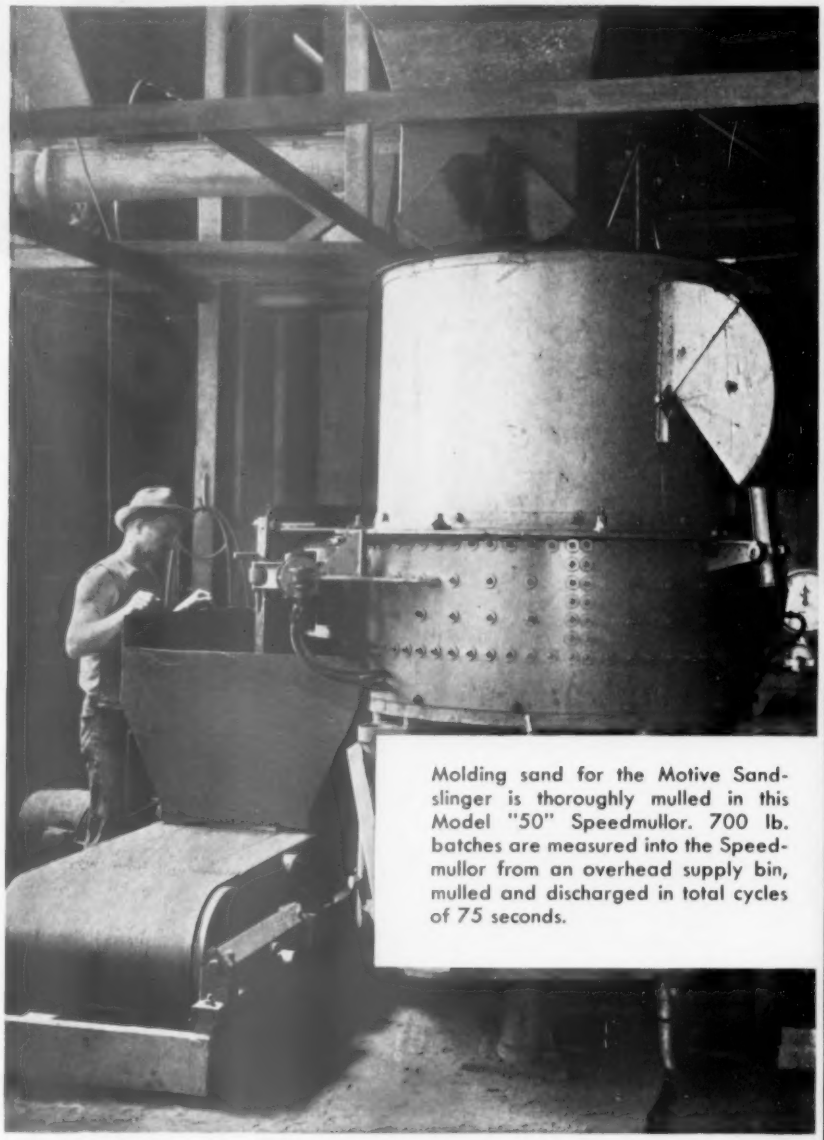


Mulled sand from the Speedmullor is carried by bucket elevator to the overhead supply bin. When the Sandslinger requires sand, the operator backs it under the twin batch hoppers and quickly loads its tank.

a month!

Fitchburg Foundry Company, Fitchburg, Massachusetts, reduced costs approximately $2,000 a month! They attribute this saving to their Motive Sandslinger, to the improved molding techniques made possible through Sandslinger ramming and to the use of completely mulled Speedmullor sand. Fitchburg's Motive Sandslinger does double duty . . . ramming both molds and large cores. Molds vary in size from 3′ x 3′ to 8′ x 30′ for castings weighing up to 30,000 lbs. The "slinger" operates on a track 130 ft. in length, ramming medium and large size flasks on both sides of the track and large pit molds at one end. For core ramming operations, the Sandslinger is positioned alongside a loop roller conveyor on which the core boxes are handled. Core sand is loaded into a floor level hopper, carried by an inclined belt to a chute on the "slinger's" bucket elevator and discharged directly into the buckets. This ingenious arrangement is an excellent example of Sandslinger flexibility.

The Sandslinger has enabled Fitchburg to reduce molding costs by as much as 50% on some molds and Speedmullor mulled sand has greatly improved the quality of their castings. Speedmullor mulling and Sandslinger ramming have resulted in savings of $2,000.00 each month . . . savings like this can be made in *your* foundry. The full story of Fitchburg Foundry appeared in the February, 1950 issue of Better Methods. A copy is available on request.



Molding sand for the Motive Sandslinger is thoroughly mulled in this Model "50" Speedmullor. 700 lb. batches are measured into the Speedmullor from an overhead supply bin, mulled and discharged in total cycles of 75 seconds.

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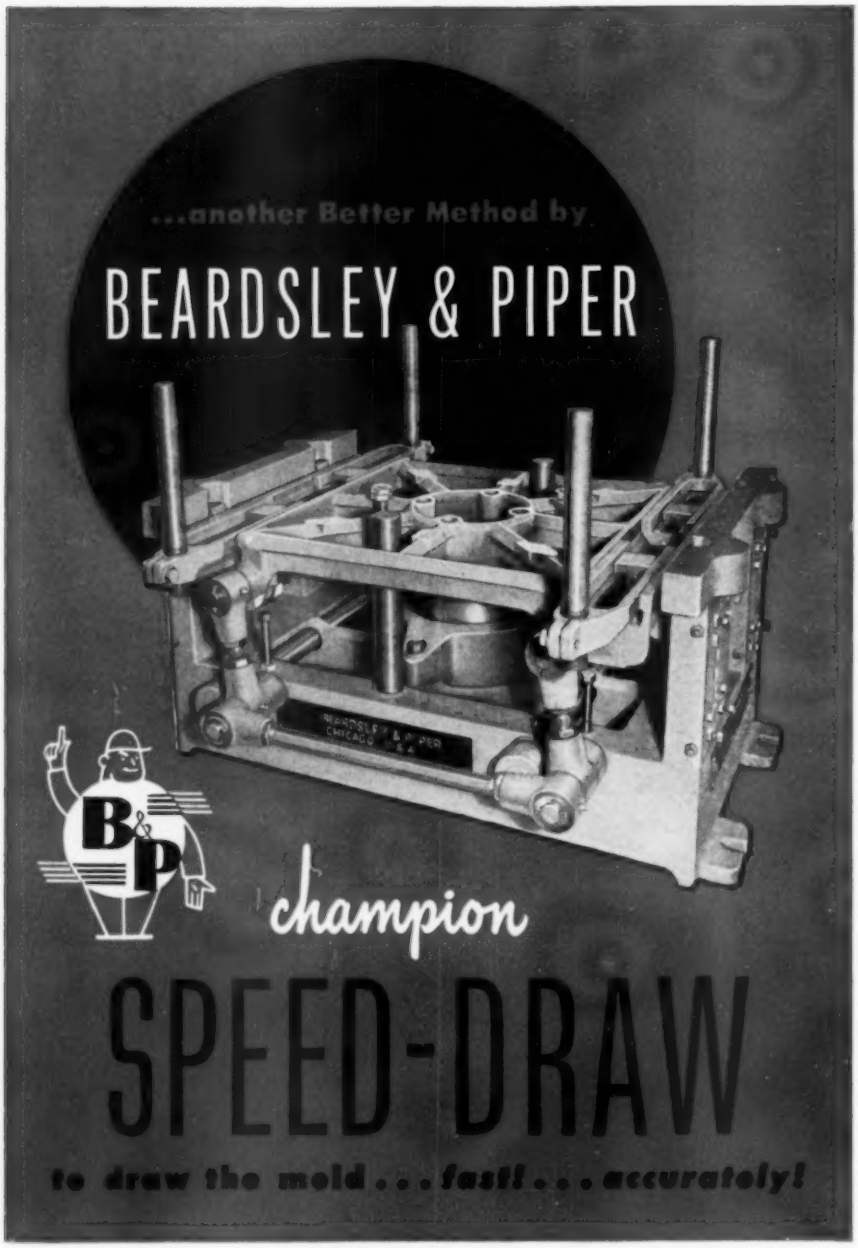

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(Continued from page 141)

Soundness of Cast Steel Plates," H. F. Bishop, Naval Research Laboratory, Washington, stated the largest plate section having a width-to-thickness ratio of 3 to 1 or greater which can be made radiographically sound with a single riser without recourse to padding or chills is one for which the distance from the perimeter of the riser to the edge of the casting is equal to 4½ times the casting thickness. Of this distance, 2½ times the casting thickness is made sound by the chilling effect of the casting edges. These findings apply to plates fed by riser having diameters equal to, or greater than, three times the casting thickness. Use of extra-large risers on plate castings was found to have no measurable effect on the distance which could be made sound.

Research Committee Reports

The riser and chill-edge relationships result from the development of three thermal zones during the solidification of plate castings: (1) A gradient zone adjacent to the riser, (2) a gradient zone at the casting edges, and (3) an intermediate zone between these two which is essentially without a gradient. As solidification progresses, the two gradient zones grow toward each other at the expense of the intermediate zone. Complete soundness will be obtained if these zones can join or can at least reduce the intermediate region to a width less than the casting thickness before solidification is completed.

Report of the Steel Research Committee was presented by its chairman, Clyde Wyman, Burnside Steel Foundry Co., Chicago. This was a progress report on the group's fundamental study of the influence of mold and core sand properties on development of hot tears in steel castings. The first progress report, made a year ago, had set forth the inconsistencies of results obtained. Consequently, work of the past year has indicated further problems for study in connection with the cause of hot tears. It was obvious that other factors in conjunction with the mold materials would have to be studied to obtain the information desired. Hope that these factors could be held constant was not realized.

One of the problems which the committee faces is to develop a test piece that will produce results which will fall within a consistently narrow range. If this can be accomplished, evaluation of binders and the relation to hot tear formation can be undertaken with reasonable accuracy. As result of work done during the

past year at Burnside Steel Foundry Co., American Steel Foundries and Armour Research Foundation, the latter will prepare a test program in which a number of foundries will be asked to co-operate by conducting tests in accordance with the outline.

Mr. Wyman said the committee hopes through such a procedure to obtain sufficient test data so that analysis may be made for evaluating the hot tear test casting. It also is hoped to establish the number of such castings which must be made to obtain consistent and reliable results.

Victor E. Zang, Unitcast Corp., Toledo, presided at the Steel Division's roundtable luncheon Thursday. Discussion umpire was R. E. Kerr, Pettibone Mulliken Corp., Chicago, acting as co-chairman. On hand to contribute their views to such subjects as factors affecting fluidity, influence of atmospheric humidity on porosity, and use of the "spiral length test" in conjunction with thermocouples to determine carbon content, were: Dr. Clarence H. Lorig, Battelle Memorial Institute, Columbus; John F. Lacey, Commercial Steel Casting Co., Marion, O., and chairman, SFSA Technical and Operating Group; Charles Locke, Armour Research Foundation and AFS Steel Division chairman; Stanley Brinson, Norfolk Naval Shipyard; Howard Taylor of MIT; and Charles W. Briggs, Steel Founders' Society of America, Cleveland.

Discuss Gating and Risering

Final steel session, a joint meeting with the Gray Iron Division, had an exceptionally informative program concerned with gating and risering principles. Chairmen were Tom W. Curry, Lynchburg Foundry Co., Lynchburg, Va., and H. H. Kessler, Sorbo-Mat Process Engineers, St. Louis.

A discussion of the fundamentals of risering, by Charles F. Walton, Case Institute of Technology, Cleveland, comprised a series of unusual colored slides which clearly explained the principles involved in effective use of risers to produce sound castings. Mr. Walton explained that more data on the subject is needed; nevertheless sufficient information is available to develop good risering practice based on sound engineering principles.

The concluding presentation dealt with gating and included a paper and motion picture. The paper, "Principles of Gating," by W. H. Johnson, W. O. Baker and W. S. Pellini, Naval Research Laboratory, Washington, was given by Mr. Pellini. The motion picture, prepared by Messrs.

(*Continued on page* 147)

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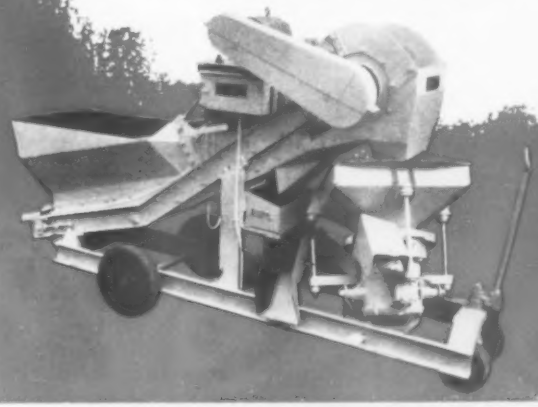
The new Junior Nite-Gang, a portable sand conditioner for the small or medium size foundry, economically produces up to 40 tons of *completely* conditioned sand per hour! The Junior Nite-Gang is easily moved to any floor in the foundry. Shakeout sand and new sand or bonding additions are loaded directly into its hopper by front end loader, crane bucket or other means. This sand is carried by a cleated conveyor belt through an adjustable feed gate and discharged over a magnetic separator. The blended, iron free sand falls onto the high capacity Screenarator which completely screens, aerates and discharges it into bin, pile or windrow. The swivel-mounted Screenarator with adjustable discharge chute permits discharge to any distance within fifty feet and in any direction within an arc of 180 degrees.



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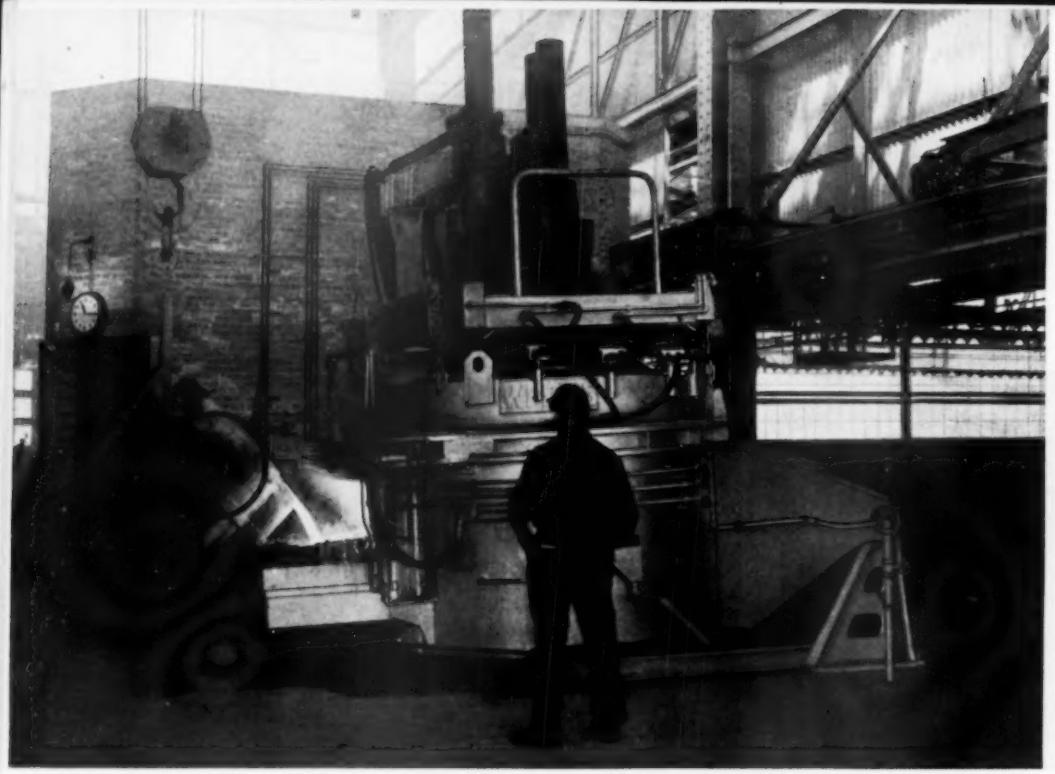
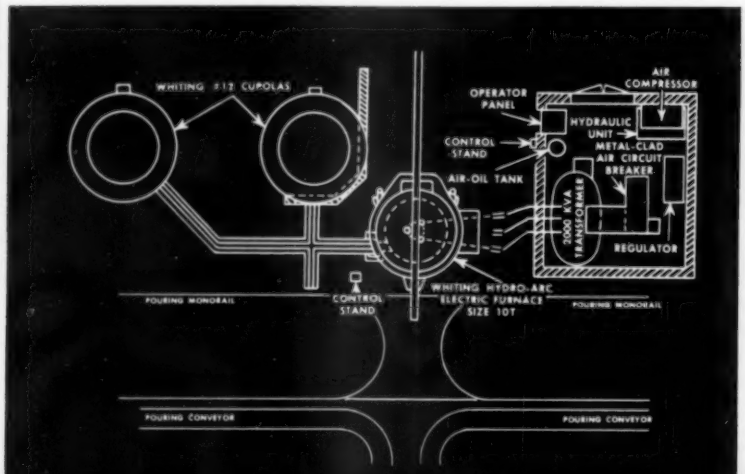


Duplexing installation in which hot metal is carried to the Hydro-Arc Furnace with a ladle.

Cupola-to-Electric DUPLEXING

—a solution to low-quality coke problems



Typical cupola-to-electric duplexing layout complete with pouring system

By using a Hydro-Arc Furnace that matches total cupola capacity, melters are increasing production, getting proper pouring temperatures at all times, and reducing machine shop rejections.

Other savings (such as continuity in pouring, increased yield from alloys, and finer grain castings of higher strength) help to make cupola-to-electric duplexing repay its entire cost in a comparatively short time.

The versatility of Hydro-Arc Electric Furnaces, combined with the ingenuity of Whiting engineers, make this equipment adaptable to almost any foundry requirements. A Whiting representative will gladly call to discuss it with you.

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(*Continued from page* 145)
Johnson and Baker, depicts the pouring of steel and shows the effect on flow of choke control in systems having a centrally located sprue. Discussion of gating principles and views incorporated in the motion picture are presented in detail elsewhere in this issue.

Precision Investment . . .

TWO papers on the subject of precision investment casting were presented at one session under the joint chairmanship of L. E. Grubb, International Nickel Co., Bayonne, N. J., and T. E. Moore, Ransom & Randolph Co., Toledo. The first paper, "Casting Aluminum in Moist Investment Molds," prepared by S. Lipson and H. Rosenthal, Frankford Arsenal, Philadelphia, and presented by Mr. Lipson, dealt principally with a long series of experiments with various materials designed to exert a chilling influence on the metal. Excess moisture under proper control was the most satisfactory medium. The molds were dried first at a temperature of 300° F, followed by a final drying at 800° F. The talk was illustrated by a number of slides. In the ensuing discussion the principal interest centered in the amount of water in the investment material.

The second paper "Pattern Materials and Production in Precision Investment Casting," was presented by the author, E. I. Valyi, A.R.D. Corp., New York. This paper also was illustrated by a number of slides. According to the speaker, the functional requirements of a pattern material include: It must be moldable; it must be dimensionally stable until a refractory mold has been formed around it; it must be capable of elimination from the refractory mold. A great number of available substances answer this description. In the order of their occurrence in industry through the years, the following grouping of pattern materials suggests itself: Waxes, natural and synthetic; low fusing alloys; plastics; frozen mercury (and other liquids). Since a great deal can be accomplished within the intrinsic property limits of any material group, the ultimate test becomes one of production economy, as represented by tooling cost, material cost and molding cost.

Following an exceptionally complete and detailed description of the various materials and their application, the speaker presented these conclusions: The cost of waxes may be reduced and quality increased by reinforcement of comparatively low-grade waxes and paraffins with carbon black, and more effectively with polyethylene. To increase production economy and improve the significant properties by a wide margin over waxes, and to further reduce material cost, plastics are employed that deviate from those used in other industrial applications and thus had to be developed for this specific purpose.

Metal patterns made from eutectic bismuth alloys show considerable promise, but as yet have not been applied industrially. They tend to overcome some of the drawbacks of frozen mercury, which thus far was used on a limited scale with satisfactory results insofar as quality of ultimate castings is concerned, but not with regard to production cost. At present plastic patterns appear to have proven best, everything considered.

Gray Iron Shop Course

FIRST of three well-attended evening sessions sponsored by the Gray Iron Shop Course Committee was under the direction of K. H. Priestley, Vassar Electroloy Products Inc., Vassar, Mich., and E. J. Burke, Hanna Furnace Corp., Buffalo.

E. W. Deutschlander, Worthington Pump Co., Buffalo, in a discussion of "Pouring Practice for Gray Iron," described methods in use at that plant and stated that the most satisfactory pouring practice is the one that gives the best results. In considerable detail Mr. Deutschlander covered the subject of gates and risers, shrinkage, runners, shrink bobs, time element on pouring of castings, and core expansion. Slides were used to illustrate applications of methods, ranging from pouring of the larg-

DISPLAY: Northeastern Ohio Chapter of the AFS sponsored a display featuring Cleveland's foundry industry in the window of Second Federal Savings & Loan Association, Cleveland, Apr. 28 to May 12. The 30-ft window contained representative castings from 12 Cleveland foundries and showed the step-by-step process of casting a pipe wrench handle from master pattern to finished product. Full size patterns, molds, flasks, cores, and rough and finished castings were used in this part of the display

est cylinder made at the plant with various types of outside gates, down to small compressor pistons made in halves, the risers made with umbrella cores. In the general discussion points were clarified regarding temperatures, tapping, control of gases, formulas, sizes of gates and risers, pencil gating, and pouring of cylinder liners.

About 200 attended the second meeting, with E. J. Burke, Hanna Furnace Corp., Buffalo, presiding, and Waldeck W. Levi, Lynchburg Foundry Co., Lynchburg, Va., acting as co-chairman. B. P. Mulcahy, Fuel Research Laboratory Inc., Indianapolis, in a paper entitled "Cupola Bed Practice," stated that although the importance of correctly burning-in the coke bed has been emphasized in cupola operation discussion, in many instances the bed is poorly conditioned. His purpose was to point out fundamental factors in construction of a proper bed, means of detecting improper conditions and their correction.

Varied methods of lighting the initial coke bed were discussed. Advantages and proper use of wood were outlined. This method is losing favor because of the scarcity of good, dry wood at a reasonable price; process of building the fire is slow and cumbersome, the wood is too green or wet; and it is too hard or heavy. Oil or gas torches often are used to start the fire. One or more burners are inserted in tuyeres or in special ports cut in the base area directly at the sand bottom level. Gas is not as convenient as oil. It requires availability of supply and a line at the cupola.

Recently a patented electric lighter has appeared which operates on the principle of an electric arc drawn by a high ampere current. This system is faster than gas or oil because it is easier to ignite the bed at several points. Principal disadvantage is the cost of equipment. With salamander or external firing a bed of coke is fired by a gas burner in a special container on the ground. The amount of coke is sufficient to fill the cupola to at least 12 in. above the tuyeres so that subsequent coke can be properly ignited. Extra work is involved in this system but it has an advantage of creating a uniformly lighted bed.

Burning-in the bed was described with particular attention to care of tuyeres, natural draft and use of air from the blower. The speaker claimed that the bed is ignited properly only when the state of combustion of coke is uniform throughout entire bed. He developed the subjects of poorly ignited beds, overburned beds, flux, coke bed heights, stock size effect on bed height, and determination of correct bed height. It is impossible to calculate a correct bed height for any particular operation, but if the mode of adjustment suggested were followed and recommended conditions observed in burning in the bed, the coke bed could be eliminated from the list of uncertain operations. In the ensuing discussion carbon shooting, high amounts of carbon, and pollution of atmosphere by cupola stack discharges were discussed.

Discuss Cupola Refractories

At the concluding course Howard H. Wilder, Foundry Division, Eaton Mfg. Co., Vassar, Mich., presided, with E. J. Burke, Hanna Furnace Corp., Buffalo, as co-chairman. A discussion panel consisting of T. Giszczak, research metallurgist, American Foundrymen's Society, Detroit, and E. J. Lally, Forest City Foundries Co., Cleveland, discussed "Cupola Refractory Practice."

In his talk Mr. Giszczak pointed out that cupolas are lined to confine heat to the inside. Some heat is lost, however, depending upon the refractory conductivity, and the loss is proportional to the amount of heat inside the cupola. The greater the heat conductivity of a refractory the thinner the plastic layer on the inside diameter of the refractory lining and the less abrasion loss. A thick lining is more susceptible to abrasion and slag penetration.

As to the effect of slag on refractory, Mr. Giszczak stated the consumption of a cupola lining decreases as silicon in the iron being melted increases. More heat is needed for a heavy slag, thus the lining is plasticized to a greater extent, and excessive abrasion occurs. Also, cupola linings operated under oxidizing conditions burn out faster.

The speaker listed causes of refractory failure as: Corrosion, abrasive action prior to fusion and after the fusion temperature is reached, impact breakage, thermal effects, severity of operation, and gaseous erosion.

He went on to discuss contour linings; water-cooled tuyeres; the conical, water-cooled cupola, and the wellless cupola.

In his talk, Mr. Lally discussed

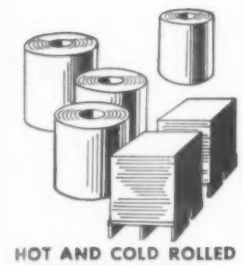
(*Concluded on page* 150)

Sound Film Shows Importance of Safety Shoes

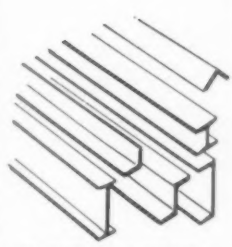
"ONE Ounce of Safety," a sound motion picture promoting the importance of wearing safety shoes, has been produced by Hy-Test Division of International Shoe Co., 1509 Washington Ave., St. Louis 3, for use by industrial safety directors. It is said that most of the 60,000 foot injuries occurring each year throughout the country could be prevented by wearing protective footwear.

To assist safety directors in conducting meetings, a manual with opening and closing remarks, projectionist's check list and a suggested questionnaire for after-meeting discussions is supplied with the film. In addition, a booklet emphasizing facts about safety shoes as presented in the film is available for distribution to each worker attending the film showing.

Produced by Sarra Inc., with the National Safety Council serving as technical advisor, the film is available from Hy-Test Division, International Shoe Co.

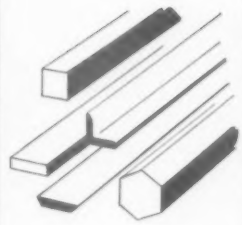


HOT AND COLD ROLLED SHEETS AND STRIP



STRUCTURAL SHAPES

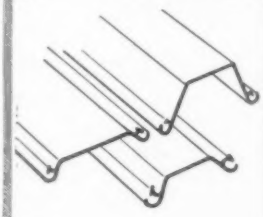
CARBON STEEL PLATES



CARBON STEEL BARS

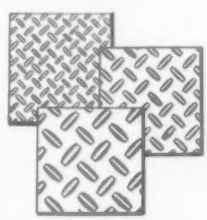
RAILS AND TRACK ACCESSORIES

HI-BOND* REINFORCING BARS

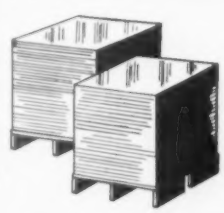


SHEET PILING

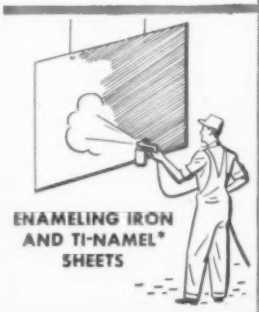
GALVANIZED SHEET PRODUCTS



4-WAY* SAFETY PLATE

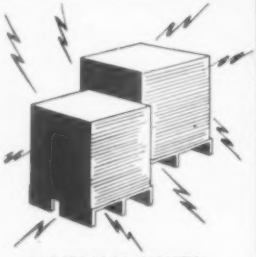


TIN MILL PRODUCTS

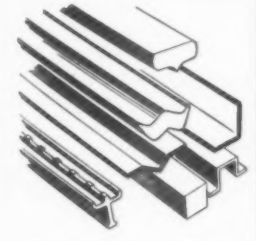


ENAMELING IRON AND TI-NAMEL* SHEETS

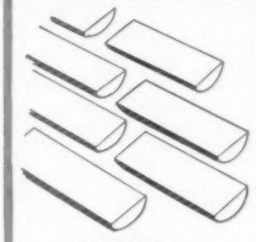
you can rely on INLAND for the RIGHT STEEL



ELECTRICAL SHEETS



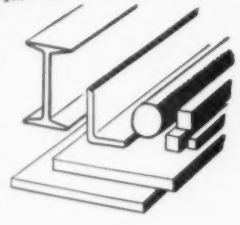
RAIL STEEL PRODUCTS



PIG IRON

LIMESTONE

COKE BY-PRODUCTS



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(*Concluded from page* 148)

two No. 9 cupolas melting 125-150 tons per day. In his opinion, cupola linings depend on the demand for iron and the size cupola. Discussing types of linings used, he stated that when sandstone sawed against the grain was used in the melting zone, refractory loss was reduced 40 per cent. He advocated a contour patch when good coke is available for melting and a straight patch for inferior coke.

Sand Shop Course . . .

THE Sand Shop Course, a regular feature of AFS conventions, this year consisted of three sessions. The opening session, devoted to a discussion of core and mold blowing problems, had F. S. Brewster, Harry W. Dietert Co., Detroit, as chairman. The first paper, "Fundamentals of Core Blowing Using Vented Boxes and Unvented Blow Plates," was presented by R. W. Gardner, Ford Motor Co., Dearborn, Mich.

Mr. Gardner outlined the principal considerations in preparing to blow cores: Type, size and location of vents; location and size of blow holes; design of the corebox; type of blowing machine and auxiliary equipment; and characteristics of sand to be blown. He stated that a standard rule for vent area of a box is 2½ times the blow hole area. Soft cores indicate need for additional vents or a relocation of blow holes.

The speaker recommended use of rubber-covered blow plates to resist sand abrasion and eliminate blow outs. To improve the flowability of sand, Mr. Gardner recommended perforated pipes in the blow chamber through which air is introduced into the sand, fluffing it prior to being blown into the core.

Second speaker, Arnold E. Czechowicz, the Key Co., East St. Louis, Ill., described a universal blow plate developed by that organization for use with standard corebox equipment. An article describing this blow plate was published in the April, 1950 issue of THE FOUNDRY, p. 176.

Concluding speaker was Lawrence D. Pridmore, International Molding Machine Co., LaGrange Park, Ill. His topic was "Mold Blowing." Mr. Pridmore stated that in their research it has been found sands have a rubbery quality when rammed too hard. Therefore, to produce castings to as close tolerances as the patternmakers produce patterns, it is necessary to find the ultimate mold hardness of a sand and stay within that point. Sands vary in their blowability and Mr. Pridmore said he would like to see a method developed to measure that characteristic. In blowing molds, a heavier sand must be moved into the mold cavity and blow holes are larger, generally being 1½ in. to 2 in. in diameter.

Under the direction of Earl J. Bush, Naval Gun Factory, Washington, and R. H. Olmstead, Whitehead Bros. Co., New York, the second sand shop course had John B. Caine, Wyoming, O., as discussion leader. Mr. Caine described a procedure he developed for determining how molding sand mixtures stand up against molten steel. Known as the "core dip" test, 2 in. long x 2 in. diam sand specimens are dipped into molten steel.

From such dip tests the resistance of the sand to spalling, scabbing and blowing can be ascertained, but according to the speaker, a large number of tests are necessary to obtain sound conclusions. (An article by Mr. Caine on this subject was presented in THE FOUNDRY, July, 1947.)

Concluding session of the Sand Shop Course dealt with sand reclamation. R. H. Jacoby, Key Co., East St. Louis, Ill., was chairman and H. W. Meyer, General Steel Castings Co., Granite City, Ill. co-chairman.

Cost Is Low

Principal speaker was Gordon H. Curtis, Nichols Engineering & Research Co., New York. Mr. Curtis pointed out that in general, reclaiming sand costs less than new sand, especially if the foundry is any distance from the pits; also where disposal of waste sand is a problem. Reclamation also provides excellent control of sand properties and enables foundries to store dry sand.

A properly designed sand reclamation system should produce sand with physical properties the equivalent of new sand. Principles of reclamation are the removal of clay, classification to remove fines and elimination of moisture. To remove carbon and any organic material, it is necessary to raise the sand to a high temperature and burn the organic content.

Clay may be removed by dry scrubbing or rotating slowly in a double wheel muller. In this method fines are removed by air separation. Dislocation of clay can also be accomplished by the addition of 70 per cent water to 30 per cent solids. Choice between the two is a matter of convenience.

The flotation principle is generally applied to remove fines in conjunction with wet scrubbing. Some foundries use a spiral classifier, others use a cone or funnel classifier in which the clay is removed by the counterflow of water. In the spiral method the sand can be dewatered and classified in the same equipment.

Using the funnel or cone equipment, sand is discharged from the cone with 35 per cent solids; by centrifugal action moisture can be reduced to about 6 per cent. The sand then can be completely dried in a rotary kiln or vertical hearth furnace. To calcine the sand, to remove carbonaceous material, temperature is raised to approximately 1400° F and the sand then cooled to 125° F for reuse.

Any number of different combinations of equipment can be used to get the final product, the combination depending on needs of the individual foundry. Application of reclaimed sand is a metallurgical problem and should be worked out by the foundry metallurgist, engineer and superintendent. Mr. Curtis pointed out that where a foundry's operation does not require an organic-free sand, the calcining operation is unnecessary.

In later discussion it was pointed out that by one wet scrubbing process reclaimed sand was found to have the same if not better physical properties than the original sand. It was felt that better grain distribution developed the higher strength.

Plan Heat Transfer Discussion

Postwar heat transfer development will be the theme of an international discussion to be held in London, Sept. 11-13. Plans for participation by engineers in the Western Hemisphere are being arranged by the Joint Committee on North American Participation, which consists of representatives from 11 American technical engineering societies and the Engineering Institute of Canada. American Society of Mechanical Engineers is co-ordinating administrative details. Participation by British and European engineers is being coordinated by the Institution of Mechanical Engineers with co-operation of 30 British societies and engineering and technical societies of Australia, India, New Zealand, South Africa, Belgium, Denmark, France, Holland, Norway, Sweden and Switzerland.

Mold Wash Report

"A Study of Mold Washes for Sand Molds" is the title of a new Office of Naval Research report now available from the Office of Technical Services, Commerce Department, Washington 25, D. C. Identified as PB 100 515, it may be had for 50 cents a copy.

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How CHROMIUM BRIQUETS Increase Hardness and Strength of Cast Iron

Chromium briquets are made especially for the addition of chromium to cast iron in the cupola. The amount added may vary from small percentages up to as high as 15 per cent.

Function of Chromium in Cast Iron

Chromium is added to cast iron for the purpose of refining the grain and stabilizing the combined carbon content, thus increasing strength, hardness, and resistance to wear and abrasion. Even very small additions of chromium have a decided effect, and as little as 0.25 to 0.50 per cent will yield a great improvement in iron used for resistance to wear. A typical application is in automotive cylinder castings, particularly in heavy-duty truck and tractor work.

The stabilizing and refining effect of chromium is particularly useful to foundrymen producing castings of medium to heavy section. The slow cooling of such castings often results in weak, open-grained iron. Chromium in amounts up to 1.00 per cent will increase the stability of the structure of the castings and help to offset the effect of slow cooling in the mold.

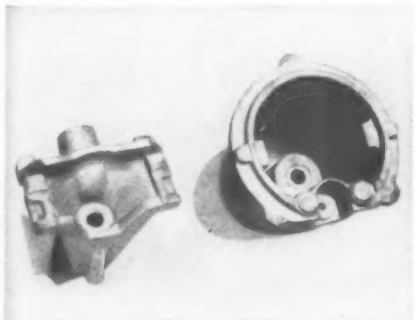

Fig. 1—These low-chromium iron castings, which are parts for a die-casting machine, are machinable, uniformly hard, and resistant to the effect of high temperature.

High-Temperature Service

The strong effect of chromium in stabilizing the structure of gray iron has made its use in iron subjected to high temperatures almost universal. Chromium in the range of 0.75 to 1.25 per cent greatly reduces the growth and warping that occur in unalloyed irons as the result of repeated heating and cooling. Chromium cast irons in this range of chromium content may be inoculated with silicon alloys to decrease the tendency to chill and, also, to assist in maintaining machinability. Such irons are adaptable to various high-temperature applications, such as melting pots, die-casting machine parts, grate bars, etc.

How Binder Protects Chromium

For the addition of chromium to cast iron, ELECTROMET produces briquets containing exactly 2 lb. of chromium each. The alloy is protected by a refractory binder, which has a high melting point and, therefore, helps to prevent oxidation of the chromium until it is melted and delivered to the crucible of the cupola.

The recovery of chromium from "EM" briquets is thus uniformly high, normally above 85 per cent, and it is easy to obtain the desired final chromium content. This is of particular importance when the limitations of hardness and machinability for a casting demand close chemical control.

Typical Briquet-Iron Mixture

The use of "EM" chromium briquets in the production of cast iron of low chromium content is shown in the table below.

Fig. 2—"EM" chromium briquets are hexagonal in shape, and each contains exactly 2 lb. of chromium. Notched briquets (right), which are easy to break in half, can be purchased for use when 1 lb. additions of chromium are desired.

The mixture given is for a medium-strength iron used for castings in which resistance to wear or heat is required.

Booklet Available

Typical briquet mixtures for other types of irons are given in the booklet "Briquetted Alloys for the Iron Foundry Industry." This booklet also contains information about "EM" briquets of silicon, silicomanganese, and ferromanganese. If you would like a copy, free of charge, simply write to the address given above or to the ELECTROMET office nearest to you. Offices are in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York and San Francisco. In Canada: Welland, Ontario.

The terms "EM" and "Electromet" are registered trade-marks of Union Carbide and Carbon Corporation.

Typical Briquet Mixture for Low-Chromium Iron

Base Charge			Alloys in Charge Material					
			Silicon		Manganese		Chromium	
Per Cent	Lb.	Material Charged	Per Cent	Lb.	Per Cent	Lb.	Per Cent	Lb.
20.0	200	Pig Iron	2.25	4.50	0.85	1.70	—	—
30.0	300	Return Scrap	2.00	6.00	0.75	2.25	0.57	1.71
30.0	300	Purchased Scrap	2.00	6.00	0.65	1.95	—	—
20.0	200	Steel Scrap	0.10	0.20	0.45	0.90	—	—
100.0%	1,000 lb.	Total Base Charge		16.70 lb.		6.80 lb.		1.71 lb.
Briquets Required		5 Silicon Briquets		5.00		—		—
		1 Silicomanganese		0.50		2.00		—
		2½ Chromium Briquets		—		—		5.00
		Total Alloys Charged		22.20 lb. Si or 2.22% Si		8.80 lb. Mn or 0.88% Mn		6.71 lb. Cr or 0.67% Cr
		Melting Recovery		x .90		x .85		x .85
		Final Iron Analysis		2.00% Si		0.75% Mn		0.57% Cr

Activities of Foundry GROUPS

Eastern Canada & Newfoundland

PAST chairmen of Eastern Canada Chapter of the AFS were honored at the group's Apr. 14 meeting held at the Mount Royal Hotel, Montreal. Technical chairman was W. T. Shute, Canadian Car & Foundry Co. Ltd., and featured speaker was Chester V. Nass, vice president, Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago. His subject was "Better Methods for Sand Molds and Cores." Discussing mulling equipment, Mr. Nass followed his talk with a movie and slides illustrating his various points.—*A. J. Moore, Montreal Bronze Ltd.*

Rochester

PAYING tribute to the outstanding leadership of Chapter President Herman G. Hetzler, Hetzler Foundries Inc., Rochester, N. Y., more than 350 members and guests of Rochester Chapter of the AFS met at the Hotel Seneca May 19 for the annual business meeting. Seated at the speakers' table were civic and business leaders, including Samuel B. Dicker, mayor of Rochester.

Henry B. Hanley, foundry manager, American Laundry Machinery Co., one of the chapter's organizers and its first president, reviewed the substantial progress made during its comparatively brief history. Prior to a fine program of entertainment arranged by Charles Vaughn, Ritter Co. Inc., Rochester, N. Y., these officers and directors were elected unanimously:

President, Kenneth R. Proud, Anstice Co. Inc., Rochester; vice president, Charles Vaughn, Ritter Co. Inc., Rochester; and secretary-treasurer, Duncan Wilson, Engineered Castings Division of American Brake Shoe Co., Rochester. Directors for three years: Leon C. Kimpal, Rochester Gas & Electric Corp.; John Racinowski, Rochester-Erie Foundry Corp.; W. B. Sattler, Whitehead Bros. Co. Herman G. Hetzler, retiring president will serve as a director for one year.—*Donald Webster, American Laundry Machinery Co.*

Northeastern Ohio

NORTHEASTERN Ohio Chapter of the AFS held Old Timers' and Past Presidents Night, and election of officers and directors, May 25, at Tudor Arms Hotel, Cleveland. Of the 225 members and guests present approximately 75 were old timers.

Heading the group of past presidents was Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, first president of the chapter (1935-36) and president-elect of the national AFS. In recognition of the latter honor, Mr. Woody was presented a brief case by the chapter. In a short talk on AFS activities he stated that next year's technical convention will be held at Buffalo and the 1952 show and convention will be held at Atlantic City, N. J.

Other past presidents at the meeting included: Leroy P. Robinson Werner G. Smith Co. (1938-39); Frank J. Dost, Sterling Foundry Co. (1941-42); Jack H. Tressler, Hickman, Williams & Co. (1942-43); James G. Goldie, M.B.M. Foundry (1943-44); Russell F. Lincoln, Russell F. Lincoln & Co. (1944-45); A. C. Denison, Fulton Foundry & Machine Co. (1945-46); Henry J. Trenkamp, Ohio Foundry Co. (1946-47), and Howard C. Gollmar, Elyria Foundry Division (1947-48).

Officers elected for the coming year are: Fred J. Pfarr, Lake City Malleable Co., president; Gilbert J. Nock, Nock Fire Brick Co., vice president; Arthur J. Harlan, Hickman, Williams & Co., secretary, and F. Ray Fleig, Smith Facing & Supply Co., treasurer.

Directors for 3 years are: R. J.

(*Continued on page 155*)

EASTERN CANADA Chapter of the AFS celebrated past chairmen's night, Apr. 14 at Mount Royal Hotel, Montreal. Shown at the directors' meeting the same day are, front row, left to right: L. Beaudry, director; E. Delahunt, national director; R. W. Bartram, honorary chairman; C. V. Nass, Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago, speaker; James H. Newman, past chairman; J. Hunt, secretary, L. Guilmette, vice chairman, and H. T. Doran, director. Back row, left to right, are: Cecil Rowe, director; Jack Richardson, director, Ontario Chapter; A. J. Moore, director; M. Chicoine, director; M. E. Fee, treasurer; Alex Watson, director; T. Shute, director; R. Bernard, H. Louette, C. Brisbois, L. Voisard, and A. Cartwright, past chairmen, and N. Prumier, director

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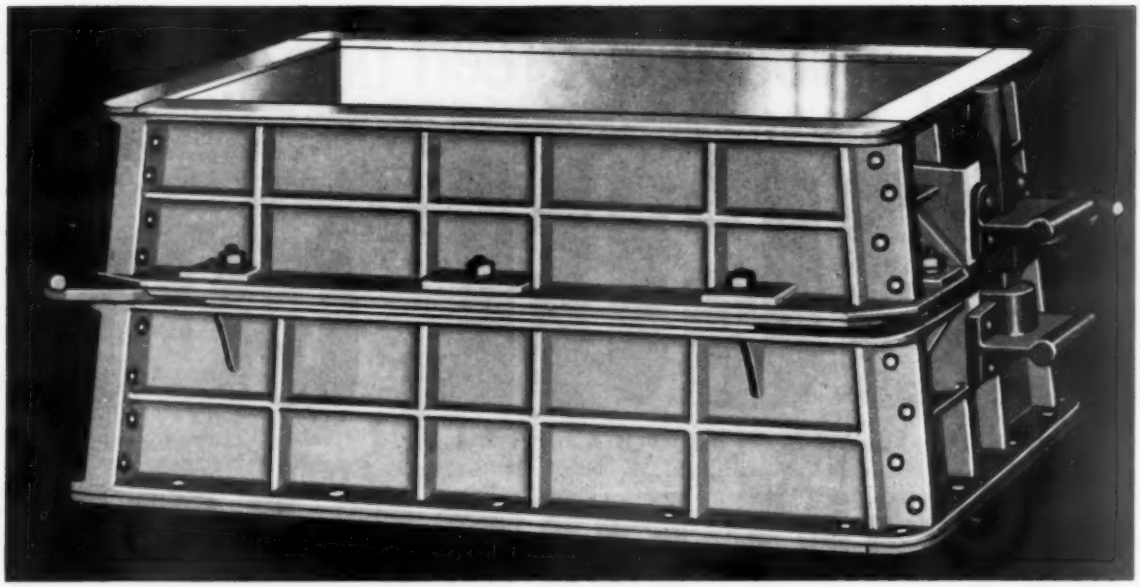

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Several Types Of Pins To Choose From

50%

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50% more molds per floor with less fatigue to the molder was attained.

Strong and light in weight, The Diamond Featherweight is the fastest and easiest operated flask on the market.

Fast operating sand strip releases flask with ease from the mold.

No clogging with sand, and no sand hanging in the corners.

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SAGINAW VALLEY Chapter of the AFS met at Fischer Hotel, Frankenmuth, Mich., Apr. 6. Shown at the meeting, left to right, are: Lyle L. Clark, Buick Motor Division, General Motors Corp., Flint, Mich.; Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., speaker at the meeting; W. W. Levi, Lynchburg Foundry Co., and E. L. Waterhouse, Eaton Mfg. Co., Foundry Division, Vassar, Mich.

(*Continued from page* 152)

Hines, Hines Flask Co.; S. E. Kelly, Eberhard Mfg. Co.; J. J. Kroecker, Aluminum Co. of America; M. C. Ross, Bellville Foundries Inc., Bellville, O.; C. F. Walton, Case Institute of Technology.

William G. Gude, THE FOUNDRY, immediate past president, was elected a director for one year.

Following the business meeting, the group was entertained by a stage show.—*Robert H. Herrmann.*

Eastern New York

FIRST joint meeting of the Eastern New York Chapters of AFS and ASM was held Apr. 18 at Circle Inn, Latham, N. Y. The affair was such a success that the officers of both groups expressed a desire to make it an annual affair.

The subject of the evening was "A Technical and Practical Discussion of Ductile Cast Iron," and the speaker was Prof. Howard F. Taylor, department of metallurgy, Massachusetts Institute of Technology. The discussion was of interest to both groups and Professor Taylor proved to be an interesting and entertaining speaker.—*George Danner, American Locomotive Co.*

Northwestern Pennsylvania

SPEAKER at Apr. 24 meeting of Northwestern Pennsylvania Chapter, AFS was Frederick G. Sefing, International Nickel Co., New York, and a national director of the AFS. Nearly 100 members and guests were present at the Moose Club, Erie, to hear Mr. Sefing discuss casting soundness as affected by gating, risering and gas porosity.

Mr. Sefing stated that all gates and risers should be designed with the principle of controlled, progressive freezing in mind. This means the thinnest sections and coldest metal should freeze first and without interruption leaving the heaviest sections and hottest metal to freeze last and to be fed by the riser. Mr. Sefing illustrated the talk with slides showing various types of castings.

The following were nominated to serve during the coming year: Chairman, Frank P. Volgstadt, Griswold Mfg. Co., Erie; vice chairman, Douglas James, Cooper-Bessemer Corp. Grove City, Pa.; with Earl Strick, Erie Malleable Iron Co., Erie, and Fred Carlson, Weil McLain Co., Erie, nominated for re-election as secretary and treasurer, respectively. New directors nominated were: Joseph A. Shuffstall, National Erie Co., Erie; C. S. Ban, American Brake Shoe Co., Meadville, Pa.; Duane P. Davis, Urick Foundry Co., Erie; and Bailey Herrington, Hickman, Williams & Co., Erie.

Chairman Shuffstall announced that the chapter's annual picnic would be held Saturday, Sept. 16, at Tyman's Grove, Erie. Charles Gottschalk, Cascade Foundry Co., Erie, is chairman of the picnic committee.—*Earl M. Strick, Erie Malleable Iron Co.*

Central Michigan

CASTING defects held the attention of more than 60 members and guests of Central Michigan Chapter of the AFS at the April meeting held at American Legion Clubhouse, Battle Creek, Mich. Speaker was W. B. McFerrin, vice president, Haynes Stellite Division, Union Carbide & Carbon Corp.

Mr. McFerrin stated a definite plan should be followed in solving casting defects. He suggested: Call in all the organization dealing with the casting; have an open and unbiased mind; consider all the facts and the equipment used. One important factor controlling defects is pouring. Iron should be poured from approximately the same height, should be eased

EASTERN NEW YORK Chapter of the AFS held a joint meeting with the American Society of Metals at Circle Inn, Latham, N. Y., April 18. At left is the speaker, Prof. Howard F. Taylor, department of metallurgy, Massachusetts Institute of Technology. Lower view shows the speakers' table

CENTRAL ILLINOIS Chapter of the AFS held a joint meeting Apr. 3 with Central Illinois Chapter of the American Society for Metals. Shown above at the meeting are, left to right: J. R. Sloan, Caterpillar Tractor Co., Peoria, Ill., ASM chapter chairman; Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., speaker at the meeting; C. W. Bucklar Jr., Superior Foundry Co., East Peoria, Ill., AFS chapter chairman, and C. W. Russell, Caterpillar Tractor Co., chapter technical chairman. Photo courtesy Caterpillar Tractor Co.

into the mold in an unbroken stream and the sprue always kept full.

Approximately 32 members of the chapter attended the sand school conduced by Frank Brewster, Harry W. Dietert Co., Detroit, Apr. 26-28 at Marshall, Mich.—*F. P. Tobakos, Albion Malleable Iron Co.*

Western New York

INSTALLATION of officers for the 1950-51 season featured the May 5 meeting of Western New York Chapter of the AFS held at Hotel Sheraton, Buffalo. New officers are:

Chairman, Alfred A. Diebold, works manager, Atlas Steel Castings Co., Buffalo; vice chairman, Edwin Deutschlander, assistant foundry superintendent, Worthington Pump & Machinery Corp., Buffalo; secretary, Roger E. Walsh, Hickman, Williams & Co., Buffalo, and treasurer, Martin W. Pohlman, Pohlman Foundry Co. Inc., Buffalo, were re-elected.

Directors to serve three years are: Joseph M. Clifford, foundry superintendent, Bison Castings Inc., Buffalo; William H. Oliver, general superintendent, American Radiator & Standard Sanitary Corp., Buffalo, and Joseph H. Sander, president, Tonawanda Electric Steel Castings Co., North Tonawanda, N. Y. Retiring Chairman John R. Wark, Wark Foundry Services Inc., continues as a director for one year.

Upon resigning as editor of the chapter's bulletin, *The Sound Caster*, Frank E. Bates turned over a scrap book containing a photographic history of the chapter and bound copies of the bulletin with the request that they be kept up to date for posterity. Jack Heysel, manager, E. J. Woodison Co., Buffalo, volunteered to take over as editor of *The Sound Caster*.—*Roger E. Walsh, Hickman, Williams & Co.*

Tennessee

FIFTY members and guests of Tennessee Chapter of the AFS met at the Maxwell House, Nashville, Tenn., Apr. 28.

Clyde A. Sanders, vice president of American Colloid Co., Chicago discussed "Sand Control and Synthetic Sand." Showing slides of various casting defects and explaining the causes and methods of correcting them through proper sand control and practices, Mr. Sanders stated many foundrymen believe metal shrinkage is due principally to metal composition, rate of pouring and metal temperature. However, the speaker showed that certain phases of molding sand properties can create metal shrinkage.

Dean Lewis of the College of Engineering, Vanderbilt University, accepted with thanks on behalf of the students, the complete technical library of foundry publications given the university by the Tennessee Chapter. He stated it filled a much needed part of their library.—*Carl A. Fischer Jr., Fischer Supply Co.*

Central Illinois

A JOINT meeting of the Central Illinois Chapters of the American Society for Metals and the AFS was held Apr. 3, with "Nodular Iron" the topic of discussion. Max Kuniansky, vice president and general manager, Lynchburg Foundry Co., Lynchburg, Va., was the principal speaker.

The Lynchburg company has been making nodular cast iron for 16 months and Mr. Kuniansky presented many interesting observations, including comments on European development gained on a recent visit to France and England. Experience to date indicates present techniques make annealing necessary when casting sections are under ¾-in.

The question period revealed the following problems in practice: Optical pyrometers do not give true readings on nodular iron because of the skin of magnesium; pinhole defects make high pouring temperatures necessary; migration of carbon from drag to cope is appreciable. It was also indicated that magnesium innoculations do not wear off and have proved effective after 34 minutes.—*John R. Nieman, Caterpillar Tractor Co.*

Cincinnati

REGULAR meeting of the Cincinnati District Chapter of AFS was held Apr. 10 at the Engineering

(*Continued on page* 158)

TENNESSEE Chapter of the AFS met at the Maxwell House, Nashville, Tenn., Apr. 28. Seated at the speaker's table, left to right, are: Dean Lewis, Vanderbilt University, College of Engineering, Nashville; Karl Landgrebe, Wheland Co., Chattanooga, Tenn., chapter chairman; Clyde A. Sanders, American Colloid Co., Chicago, speaker of the evening, and Charles Saunders, Tennessee Products Co., Nashville, chapter director

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SOLID STEEL HEADS, CAPS, MOUNTINGS. Dependable protection against the breakage that commonly occurs in "cast" cylinders when subjected to heavy shock loads in normal operation and when subjected to eccentric loads developed by cylinder misalignment. Eliminate "porosity" of castings. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

HARD CHROME PLATED PISTON RODS. 90,000 to 110,000 psi yield point heat treated stress relieved steel accurately ground, polished, then *hard chrome plated.* Highly resistant to the nicks and scratches that commonly cause power wasting leakage. *Standard construction on all Miller Air Cylinders and Hydraulic Cylinders.*

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(*Continued from page* 156)

Society with 115 members and guests present. Chairman Walter Klayer, Aluminum Industries Inc., presided. C. A. Sanders, vice president, American Colloid Co., Chicago, was the speaker and his topic was "Modern Progress in Foundry Sand Practice," in which he dealt principally with the effect of sands on metal shrinkage—*Prof. John F. Kahles, University of Cincinnati.*

Birmingham

FINAL meeting of the season for Birmingham District Chapter of the AFS, held May 19 at the Tutwiler Hotel, Birmingham, featured fine food, a good speaker and a large attendance. Retiring Chairman C. P. Caldwell, Caldwell Foundry & Machine Co., presided and introduced Biddle Worthington, research engineer, McWane Cast Iron Pipe Co., who reviewed the European trip of several men from McWane company. The party visited a number of pipe manufacturing plants.

Principal speaker was Sam Carter, assistant melting superintendent, American Cast Iron Pipe Co., Birmingham, whose subject was "Future Possibilities in Basic-Lined Cupola." All of the 110 in attendance were greatly interested in Mr. Carter's remarks and the discussion extended beyond the regular closing time. Officers and directors whose election was announced here in the June issue were installed.

The chapter's next meeting will be its annual barbecue outing in September.—*J. P. McClendon, Stockham Valves & Fittings.*

New Jersey

COST Reduction through Incentive Payment Plans" was the subject of a talk by Phil Carroll, industrial engineer, Maplewood, N. J. before the New Jersey Foundrymen's Association on Apr. 17 at the Military Park Hotel, Newark, N. J.

Mr. Carroll's talk was well received and was followed by an active question and answer period. Some of the many interesting points that he made were: Standards—the determination of how much work can reasonably be expected per hour—make possible far more effective cost control than past cost records or even budgetary control, since accounting records give dollar figures only, and without performance standards there is no way of relating the dollars to the amount of work you should get for them.

It is entirely practicable to estab-

(*Continued on page* 160)

KORGLAZE

completely

SMOOTH CORES

The illustration shown here suggests clearly how KORGLAZE works. One half of the core used in this casting was treated with KORGLAZE; the other half was untreated. The metal that lay against the KORGLAZED surface is smooth and clean; the metal that lay against the untreated surface is rough, lumpy ragged. Tests like this bring up startling contrasts, and demonstrate beyond doubt that KORGLAZE, by giving smoother cores, gives SMOOTHER CASTINGS. KORGLAZE is mixed with graphite, and the two products are stirred together cold. Cores may be dipped or sprayed, and treated hot or cold. Yes, you *can* make castings smooth as silk—KORGLAZE will do it for you. May we send you a sample?

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Cheaper
NO!
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There is real economy in paying a little more at the beginning when there is a tremendous difference in results.
20th Century Cleaning and Peening Abrasives are a QUALITY product—they do better work, last longer—in fact they cost less in the end. Investigate!

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The Leader of Malleable Abrasives.
SHOT, GRIT

Amazingly durable. It is stress relieved and there is practically no shattering. Lasts at least twice as long as ordinary abrasives, and reduces equipment wear at least 50% to 75%.

Exclusive screening process insures greatest uniformity.

20th CENTURY DRAWN STEEL SHOT

Outstanding Cut Wire Abrasive for Peening and Cleaning

It is most uniform to start with, and the outstanding durability causes the pellet size and mass to remain uniform *many* passes longer than with other types of shot.

It greatly reduces freight and freight handling cost, and reduces equipment wear amazingly.

We also manufacture an outstanding HARD IRON Shot and Grit.

The CLEVELAND Metal Abrasive Co.

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(*Continued from page* 158)

lish standards for all types of labor—indirect as well as direct—maintenance as well as molding and coremaking. The establishment of standards for some types of productive labor such as grinding, chipping, etc., makes it possible to charge these operations directly to the job, thus giving much more accurate job costs than if they were applied on an average or overhead basis as has been done for many years and still is current practice in a number of present day foundries.

Time study usually shows up an amazing amount of lost time due to delays, poor servicing, waste motion, etc., for which management is responsible and which management had never before made any real effort to discover. A large part of the increase in production (which often amounts to 100 per cent) resulting from standards and incentives is due to the elimination of this lost time. Where incentives are in effect, much better supervision is required—not necessarily in quantity but in quality. In day work operation, the foreman keeps after the man to get a fair day's work; in incentive operation, the man keeps after the foreman to keep lost time down to a minimum and consequently increase his production.

The determination of individual job standards by reference to standard data instead of by time study of each individual job, requires far less time study and is in every way more efficient and satisfactory, and it is the only practicable method to use in a jobbing foundry.

The stimulus to greater effort which results from incentive systems is due not only to the desire for more pay, but also to a desire to excel others and thus qualify for advancement. It is therefore good policy to post each man's production daily. From 75 to 90% of the value of *good* time study results from gaining the confidence of the men in the fairness of the standards.

Pittsburgh

THREE sound-color films produced by the Naval Research Laboratory, Washington, were shown at the regular monthly meeting of the Pittsburgh Foundrymen's Association held Apr. 17 at Fort Pitt Hotel.

These films dealt with the basic fundamentals of finger and step gating applying to steel, iron and nonferrous castings. Particular emphasis was placed on technique of reducing turbulence by distribution of metal flow as evenly as possible through

the various gates. The movies indicated fundamentals of liquid flow do not apply to metals in all respects the same as they do to water. A detailed report on this study of gating principles and views from two of the movies are presented elsewhere in this issue.

The association's nominating committtee offered the following slate for the 1950-51 term: H. B. Reed, Westinghouse Air Brake Co., president; O. Edwin Decker, Richmond Radiator Co., vice president; E. P. Buchanan, Pittsburgh Coke & Chemical Co., secretary and treasurer. Proposed executive committee for the coming year will include: Henry P. Spilker, Sterrit—Thomas Foundry Co., chairman; F. B. Mahoney, Richmond Radiator Co.; R. G. Schaefer, Schaefer-Goodnow Foundries Inc.; T. F. Dorsey, Fort Pitt Steel Casting Co.; and E. A. Blasdell, Reliance Steel Casting Co.—*Joseph C. Sullivan.*

No. Illinois and So. Wisconsin

PRINCIPAL speaker, B. C. Yearly, National Malleable & Steel Castings Co., Cicero, Ill., discussed "Cracks and Tears in Ferrous Castings," at the Apr. 11 meeting of Northern Illinois-Southern Wisconsin Chapter of the AFS held at Hotel Freeport, Freeport, Ill.

Mr. Yearly summarized briefly what is known about cracks and tears in castings. He pointed out that in changing from the liquid to the solid state, metal volume changes about 3 per cent. Similarly, castings must change dimensionally in cooling to room temperature. Some foundrymen believe hot tears occur at the temperature at which metal has no elasticity. It is also known that sulphur, phosphorus and manganese influence ductility of metal at elevated temperatures. Referring to cold cracks, Mr. Yearly stated they occur at or near room temperature because a force greater than the ultimate strength of the metal is exerted on some portion of the casting due to differences in cooling rates within the casting. It is necessary, therefore, to analyze the casting and the cracks to determine cooling characteristics and once they are known, a way may be devised to alter them. The best solution, in the opinion of the speaker, is to put the castings in hot pots and bring all critical sections up to the ductile temperature range and allow the castings to cool to room temperature.

The chapter's Mar. 14 meeting, held at the Faust Hotel, Rockford, Ill., featured J. S. Schumacher, Hill & Griffith Co., Cincinnati. His talk, "Sand Control in the Foundry," at-

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1. **CENTRI-MERGE** greatly reduces heating cost by re-circulating cleaned air in many cases, occupies a minimum of valuable floor space, is easily installed.
2. **CENTRI-MERGE** gives non-fluctuating cleaning efficiency every minute of the day, collects and disposes of dust and fumes immediately.
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6. **CENTRI-MERGE** is engineered for minimum maintenance expense, is a compact, self-contained unit, constructed for flexibility of arrangement to suit plant requirements.

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owner estimates savings of $7690 per year with Pangborn Dust Control.

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reports profit of $20 a day with Pangborn Dust Control.

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states Pangborn Dust Control saves him $14,859 a year.

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Look to Pangborn for the latest developments in Dust Control and Blast Cleaning Equipment.

STOP the DUST HOG from stealing profits with

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DUST CONTROL

tracted more than 100 members and guests.

Mr. Schumacher first discussed a core blowing problem. In trying to eliminate sticking of sand grains in coreboxes the usual remedies of using dry sand, screens or slotted vents, kerosene spray and thorough cleaning after each day's run did not solve the problem. The solution proved to be unorthodox, namely wet core sand, a long mulling cycle and cleaning the boxes with plain water. The key was in the sand mixture which consisted of 240 qt lake sand, up to 20 per cent bank sand containing 20 per cent clay and 3 per cent cereal binder, 3½ to 4 per cent water and 2¼ qt core oil. These ingredients were mulled 12 to 15 minutes. There was no measurable change in physical properties of the sand.

Mr. Schumacher said scrap can be reduced only through consistent control. This requires a capable supervisor, proper equipment, established limits of all controllable properties and a complete scrap and sand property record.—*Jerry M. Zilka, Gunite Foundries Corp.*

Connecticut Non-Ferrous

AT the Apr. 19 meeting of the Connecticut Non-Ferrous Foundrymen's Association, held at the Castle Restaurant, New Haven, Conn., C. V. Nass, vice president, Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago, discussed "Conditioning of Foundry Sands."

Mr. Nass described the operation of modern sand mulling equipment for properly conditioned sand. Dangers of over-mulling, Mr. Nass cited, were poor flowability for cereal-bonded synthetic sand, and with natural bonded sands, formation of minute small clay balls which become calcined when heated.

To prevent balling on natural bonded sands, the speaker recommended regular additions of new sand to the batch mixtures. Chief objection to under-mulling is waste of cereals, bentonites, oil, etc. In addition, under-mulling reduces permeability through higher moisture content of the sand.—*J. J. Shannon, Jenkins Bros. Co.*

Chesapeake

POPULARITY of plant visits was again evidenced by a large turnout of foundrymen from Chesapeake Chapter of the AFS for a tour of the world's largest copper refinery—the Baltimore plant of the American Smelting & Refining Co. The visitors followed the progress of the blister

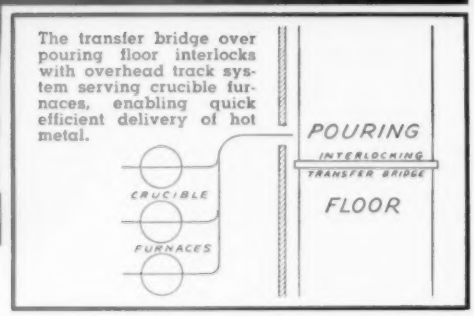
(*Concluded on page* 164)

JUMPS FROM 3 HEATS TO 8 DAILY . . .

Tramrail System works wonders in 10-man foundry

Crucibles reach the molds quickly and the work is made easy and fast.

Crucibles go direct to molds on Tramrail system.


The transfer bridge over pouring floor interlocks with overhead track system serving crucible furnaces, enabling quick efficient delivery of hot metal.
POURING
INTERLOCKING
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CRUCIBLE
FURNACES

THE installation of a small inexpensive Cleveland Tramrail hand-propelled system at the Modern Brass Foundry, Columbus, Ohio, made a terrific difference in their operations. With no increase in man power, it made possible eight heats in a day instead of three, formerly usual. Despite more than double output, the men are now less fatigued at the end of a day.

No. 70 crucibles (240 lbs. capacity) are now used instead of No. 60 (200 lbs. capacity). It has been found that very little more heat is required to prepare 240 lbs. of metal than needed for 200 lbs. This provides a big saving in heat, which in itself goes a long way toward paying for the Tramrail equipment.

When they were considering installation of the overhead equipment, Modern Brass was quite concerned over a fear that it would not be fast enough and that they would be confronted with a large heat loss that would be troublesome. This fear has proven wholly unfounded. They have learned that working with Tramrail equipment is much faster than when pouring by hand.

Mr. R. E. Gleich, president, said as far as he was concerned the Cleveland Tramrail system paid for itself the first day in operation, because it so eased their work. After the first day he knew they could never afford to be without it. As a matter of fact, the equipment actually did pay for itself within a few weeks out of savings it brought about.

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CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3829 East 286th St. Wickliffe, Ohio.

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

KWIK-MIX

Moto-Bug

has power forward and reverse

● This low-cost power wheelbarrow takes *all* the hard work out of hauling sand, coke, scrap, etc., because it has power both forward *and reverse* from 1½ to 4 m.p.h.

● Easily hauls 10 cu. ft. in big hopper, or carries 1200 lbs. on sturdy 4-ft. flat-bed. Result: bigger loads per trip, less operator fatigue, more loads per day.

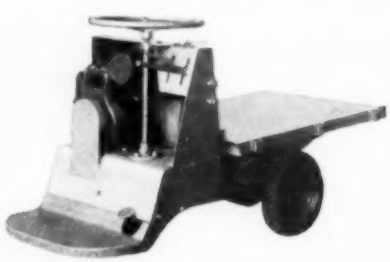
● *Standard-make*, 4 h.p., 4-cycle, gasoline engine takes full load up 20% ramps or grades. Handy 33" width clears narrow aisles and doorways . . . turns in own length.

● Moto-Bug has positive steering, direct to dual rear wheels. Large steering wheel with 3.6 to 1 gear ratio provides handling ease.

● Riding step, optional, plus positive steer arrangement, and forward and reverse power, let operator ride while traveling, spotting, and backing up.

● Dual steering wheels are standard equipment . . . dual drive wheels optional, for plenty of rubber-tired traction, flotation and handling ease on or off pavement.

● You'll find this job-proved Moto-Bug the lowest-cost answer in foundries, factories, around plant yards, etc. . . . makes man-hours 3 to 4 times more productive.



Send for complete Moto-Bug facts to: **KWIK-MIX CO., Port Washington, Wis.**

NAME ..... TITLE .....

COMPANY ..... DEPT. OR DIV. .....

STREET .....

CITY ..... STATE .....

FO KM26 REV.

KWIK-MIX COMPANY
PORT WASHINGTON, WIS.
(Koehring Subsidiary)

(*Concluded from page* 162)

copper as it was mechanically charged into 325-ton oil-fired reverberatory furnaces, melted, "poled" with green tree trunks, and cast into 700-pound anodes. The impure anodes are electrolytically refined in lead-lined tanks containing sulphuric acid and copper sulphate. The resulting pure cathodes are remelted and cast into wire bars, wedge cakes, slabs, billets, ingots and ingot bars.

The men gathered at the Engineers Club late in the afternoon for cocktails and dinner followed by an interesting coffee talk by a Baltimore traffic court judge concerning the influence of drinking on traffic accidents. The technical talk was presented by Don Lovett of the A. S. & R. Research Laboratory at Perth Amboy, N. J.

Mr. Lovett discussed aluminum foundry practice, emphasizing melting, pouring, molding, and permanent molds. Each category was accompanied by slides showing bad castings due to some error in technique. Following the talk, there were many questions from the floor.—*Jack H. Schaum, National Bureau of Standards.*

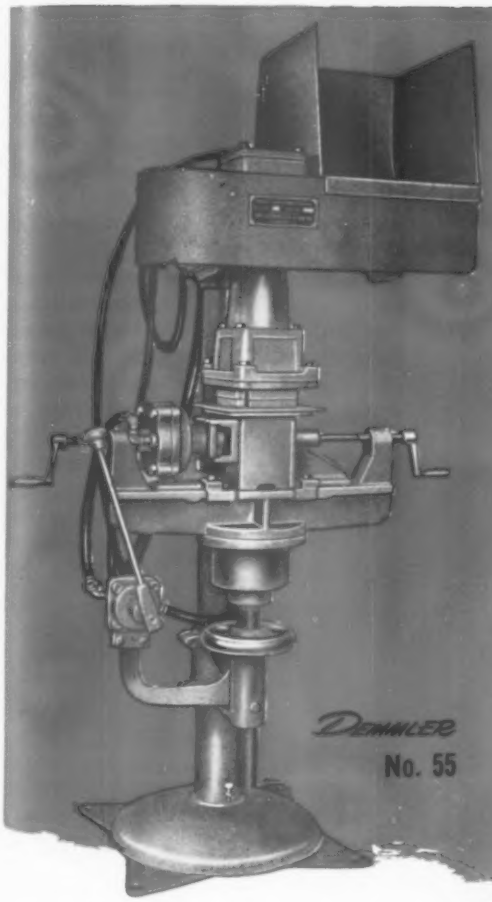
Quad City

POST-CONVENTION meeting of Quad City Chapter of the AFS was held May 15 at the Fort Armstrong Hotel, Rock Island, Ill. Technical session had as principal speaker Walter E. Sicha, chief of the Cleveland Research Division, Aluminum Co. of America, who talked on "Aluminum Alloys—Fabrication and Application."

Following the meeting, the AFS research film, "Fluid Flow in Transparent Molds," was shown. Mr. Sicha, a member of the Aluminum-Magnesium committee which produced the picture, gave a running commentary on the film.

The following officers were elected to serve during 1950-51: Chairman, H. A. Rasmussen, General Pattern Corp., Moline, Ill.; vice chairman, William C. Bell, Frank Foundries Corp., Moline, Ill.; secretary-treasurer, Robert E. Miller, John Deere Planter Works, Moline. Directors for three-years: L. W. Johnson, Swanson Foundry Co., Moline; A. D. Matheson, French & Hecht Division, Kelsey-Hayes Wheel Co., Davenport, Iowa; C. R. Marthens, Marthens Co., Moline.—*R. E. Miller, John Deere Planter Works.*

Grede Foundries Inc., Milwaukee, has acquired a 66-acre tract on North 76th St., Granville, Wis., along the North Western railroad tracks.



INCREASE PRODUCTION FOR
GREATER PROFITS
WITH
DEMMLER
CORE BLOWERS

Today's high manufacturing costs and stiff competition make high production at low cost an absolute necessity.

That's why scores of foundries have recently added Demmler core-blowers or replaced their less efficient machines with Demmlers. You, too, can increase your profit margin with Demmler machines. Available in a wide variety of sizes to meet every need, Demmler core-blowers represent an outstanding investment — an investment in greater profits for you!

DEMMLER NO. 55

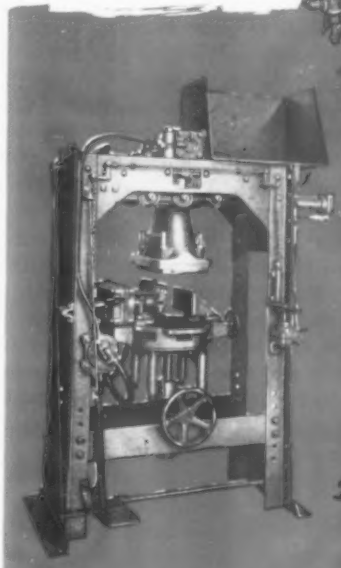
If your foundry blows small cores, you'll find the DEMMLER NO. 55 a real producer. Complete cycle takes only about three seconds! Newest addition to the long famous DEMMLER line, it has already earned the praise of foundrymen everywhere. The No. 55 will blow cores weighing up to four pounds, will accommodate boxes nine inches long. Machine has both vertical and horizontal air operated core box clamps, automatically controlled by the same valve that blows the core. Simple in construction and operation, the DEMMLER NO. 55 is ideal for short run jobs — a proven money maker! You can't afford to be without this machine.

Let us help—

You may already own one or more DEMMLER core blowers — or none at all — but in any event we may be able to suggest better applications for increased production — higher profits. Tell us about your core blowing problems; we'll be happy to help you!

DEMMLER NO. 2E

The No. 2E core blower is designed for use on cores which can be blown to advantage by attaching the top half of the core box to the blow plate and drawing the core on the machine. The cylinder has a long center guide stem which slides in a sleeve to insure a draw of extreme accuracy. Two hand valves are used to operate the machine. One moves the carriage from filling to blowing position, and the other raises the table, blows the core, and draws the core. The time of the cycle is about 12 seconds. Sand magazines available to suit customer's requirements.



DEMMLER NO. 1

General purpose machine! The DEMMLER NO. 1 needs no introduction being one of the best known — and liked — core machines in the field. Will blow cores weighing up to eight lbs.

The DEMMLER NO. 1 possesses quick job changing features. Chuck table is raised and lowered by a hand wheel. Chuck jaws are easily adjusted for different core box widths. Different size sand magazines are available. High capacity. Many of these machines have been in continuous, profitable use for more than 25 years with only minor repairs!

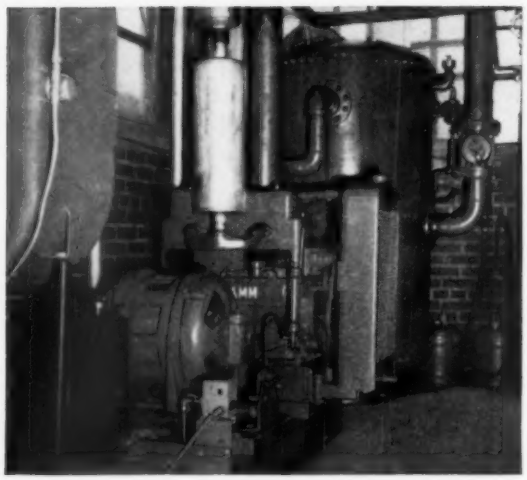
Illustrated specification sheets on any of the three illustrated machines will be sent on request

Wm. DEMMLER & BROS.

Kewanee, Illinois

MANUFACTURERS OF CORE BLOWERS EXCLUSIVELY SINCE 1911

Unistage COMPRESSORS



Model 105 Schramm *Unistage* V-Belt Driven Compressor installation in a large industrial plant. Automatic belt tightener which tightens belts in proportion to load, optional equipment at slight additional cost.

FOR PRODUCTION and MAINTENANCE FOR SPEEDY PNEUMATIC TOOLS

SCHRAMM INC. offers a complete line of Industrial Compressors in sizes ranging from ... 2 to 600 cubic feet displacement ... Built and designed for continuous heavy duty service with a minimum of attention.

Available in "V" or Flat Belt Drive ... on base for belt drive from motor or engine ... or, with direct motor drive. No special foundation required ... can be bolted to any substantial floor.

Accessories essential to any modern industrial installation can also be provided.

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Important Features

Compact ... Easy to Install
Mechanical Intake Valve
Force Feed Lubrication
100% Water Cooled
En Bloc Construction
Easy Accessibility
Vibrationless
More Bearing Surface

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

Werner G. Smith in New Core Oil Firm

Werner G. Smith, who recently resigned as executive vice president of the Archer-Daniels-Midland Co., has re-entered the core oil manufacturing business by the formation of a new and independent firm, Werner G. Smith Inc.

Already in operation, this new company is specializing in the manufacture and sale of core oils to foundries and will also process and refine China wood oil as well as other drying oils for the paint and varnish industry. General offices are at 228 Union Commerce Bldg., Cleveland, and sales offices in principal cities will soon be opened.

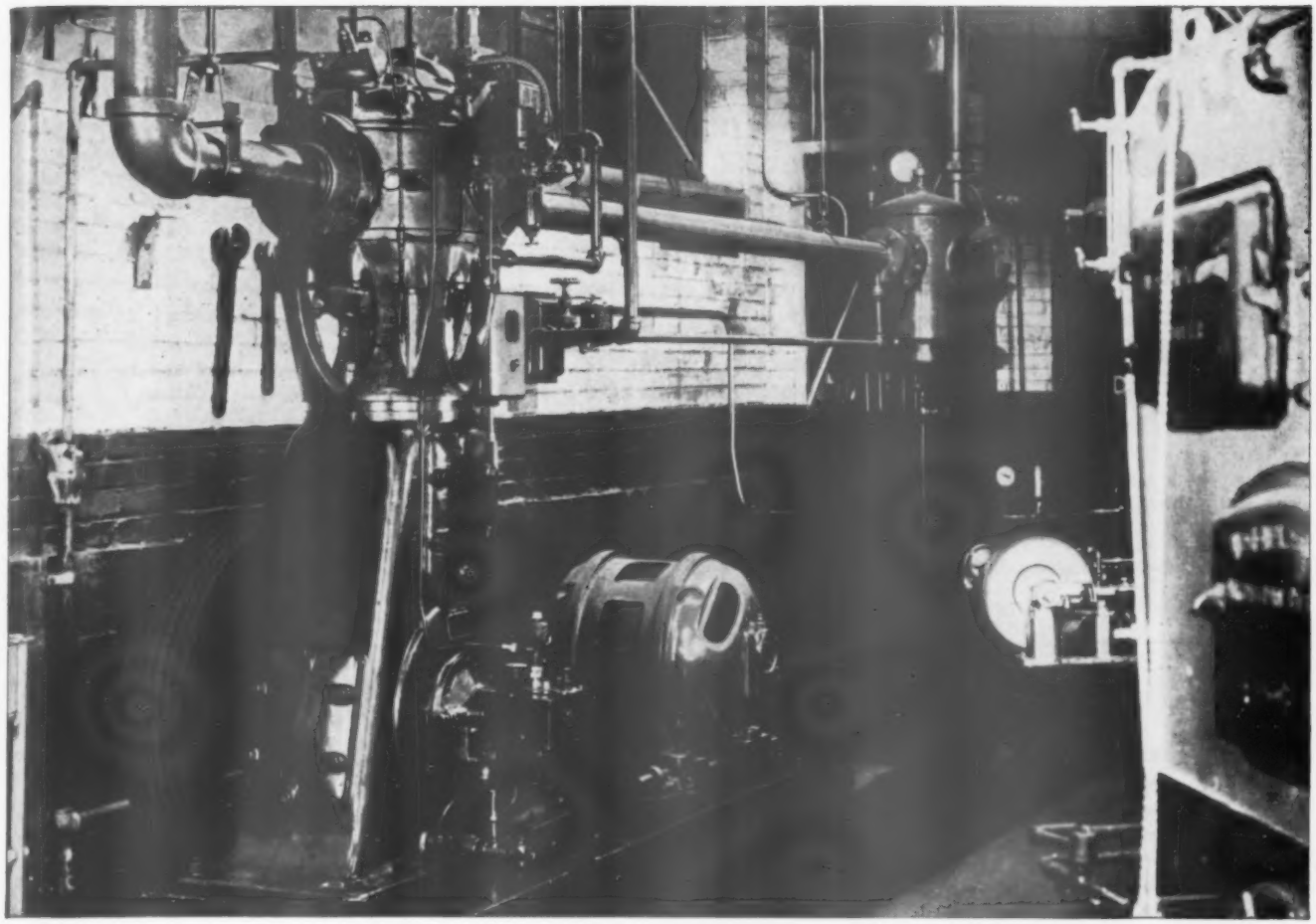
A well known figure in the foundry industry for the past 35 years, Mr.

WERNER G. SMITH

Smith was the founder and managing head of the Werner G. Smith Division of Archer-Daniels-Midland and also served as a director and executive vice president of the parent corporation.

Mr. Smith first began manufacturing core oil in 1908 when he founded a small business to help pay his way through Western Reserve University. He began blending various drying oils with the purpose in mind of producing a standard grade of core oil of uniform performance. At that time many foundries made their own favorite blend which never quite worked the same from one lot to the next. From a humble start with a small varnish kettle, his firm grew to become the largest manufacturer of core oils and also expanded its operations to include a Chemical Products Division and a Drying Oils Division.

Mr. Smith sold his company to Archer-Daniels-Midland in 1929, remaining with that corporation until May 1, 1950, as operating head of the Werner G. Smith Division. He became executive vice president of the corporation in 1948.

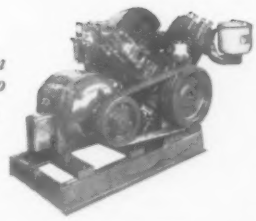


SAVE VALUABLE SPACE WITH THE EFFICIENT

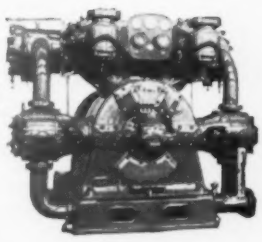
JOY WG-9 HEAVY DUTY AIR COMPRESSOR

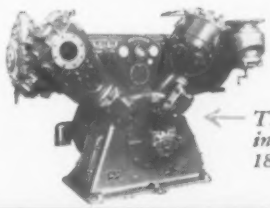
The vertical design and small base of the JOY WG-9 Compressor mean great savings in valuable floor space. Built in eleven sizes from 153 to 822 CFM, the WG-9 is designed for continuous heavy-duty service... features the exclusive JOY "Dual-Cushion" valves for top efficiency and lowest-cost operation. ● JOY builds the most modern compressors available for either centralized or decentralized air supply—*write for Bulletin.*

The JOY WL-80, in nine sizes from 81 to 590 CFM. →



The JOY WN-114, in single or twin units from 1092 to 7312 CFM. →





← *The JOY WN-112, in sizes from 378 to 1828 CFM.*

Consult a Joy Engineer

W&D 12049

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Foundry STATISTICS

Ingot Brass and Bronze

(Shipments in net tons)

	1949	1950
Jan.	19,456	18,874
Feb.	15,026	18,487
Mar.	14,550	22,494
Apr.	10,695	22,118
May	11,114	.....
June	9,696	.....
July	10,220	.....
Aug.	14,194	.....

Source: Ingot Brass and Bronze Industry.

Foundry Production Workers

ESTIMATED NUMBER

Type Foundry	Feb. 1950	Jan. 1950	Feb. 1949
Iron & Steel	176,400	172,200	219,200
Nonferrous	67,700	66,000	68,200

AVERAGE WEEKLY EARNINGS

Gray Iron	$58.31	$57.82	$57.38
Malleable Iron	59.25	59.29	56.77
Steel	61.27	58.83	61.12
Nonferrous	62.13	62.73	61.46

AVERAGE WEEKLY HOURS

Gray Iron	39.4	39.2	39.6
Malleable Iron	38.6	38.3	37.3
Steel	39.4	38.1	40.0
Nonferrous	39.5	39.7	39.5

LABOR TURNOVER RATE (FEB.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	4.6	3.2	0.9	1.9
Malleable Iron	3.9	2.1	0.9	0.9
Steel	4.3	2.4	0.6	1.5
Nonferrous	4.7	3.5	1.1	2.0

Source: Bureau of Labor Statistics.

Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1949	1950
Jan.	149.9	159.3
Feb.	144.4	113.1
Mar.	190.8	225.2
Apr.	172.0	160.6
May	121.9	....
June	164.9	....
July	146.6	....
Aug.	127.1	....
Sept.	166.6	....
Oct.	133.5	....
Nov.	270.4	....
Dec.	201.0	....

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Shipments of Castings

(Reported by Bureau of the Census)

Gray Iron

(Net tons)

	Shipments: Total	Shipments: For Sale	Unfilled *Orders
1948			
Total	12,785,909	7,131,405	.....
1949			
Feb.	986,591	535,163	1,857,403
Mar.	1,074,704	567,041	1,639,465
Apr.	929,307	467,433	1,445,532
May	866,631	439,420	1,243,266
June	905,573	455,442	1,086,989
July	696,915	341,657	1,031,963
Aug.	872,013	445,981	1,048,308
Sept.	880,647	459,014	980,070
Oct.	715,685	397,939	955,100
Nov.	718,703	395,107	938,629
Dec.	862,172	440,409	892,458
Total	10,549,284	5,517,527	.....
1950			
Jan.	913,321	449,577	914,185
Feb.	864,189	416,594	873,455
Mar.	995,782	500,195	921,575

Steel

(Net tons)

	Shipments: Total	Shipments: For Sale	Unfilled *Orders
1948			
Total	1,760,032	1,335,295	.....
Feb.	135,042	99,425	320,202
Mar.	138,889	102,027	284,754
Apr.	119,953	83,277	250,506
May	106,178	75,537	191,473
June	116,052	84,112	173,237
July	78,710	50,124	155,494
Aug.	89,964	59,412	143,566
Sept.	86,502	55,853	127,664
Oct.	70,690	48,263	124,817
Nov.	76,437	50,685	117,865
Dec.	84,508	53,079	122,887
Total	1,243,502	865,297	.....
1950			
Jan.	88,821	57,996	142,484
Feb.	91,827	62,045	165,186
Mar.	111,772	77,588	185,611

Malleable

(Net tons)

	Shipments: Total	Shipments: For Sale	Unfilled *Orders
1948			
Total	933,265	525,212	.....
1949			
Feb.	66,744	35,074	118,318
Mar.	72,052	38,143	102,379
Apr.	61,329	31,728	94,958
May	54,572	27,643	78,944
June	59,597	32,639	69,865
July	44,360	23,216	70,796
Aug.	58,121	30,327	61,330
Sept.	60,488	30,646	57,512
Oct.	57,150	28,582	54,322
Nov.	49,439	25,250	55,795
Dec.	57,379	29,679	60,835
Total	713,107	370,967	.....
1950			
Jan.	62,874	32,918	62,307
Feb.	60,386	31,249	67,049
Mar.	66,259	38,639	69,866

Copper-base Alloys

(Thousands of pounds)

	Shipments: Total	Shipments: Sand	Shipments: Perm. Mold	Unfilled *Orders
1948				
Total	1,030,825	930,790	59,009	.....
1949				
Feb.	68,776	61,278	3,951	40,517
Mar.	70,173	62,567	3,927	37,646
Apr.	59,573	52,837	3,458	32,746
May	53,699	48,004	2,830	30,926
June	52,616	47,678	2,552	26,788
July	43,273	39,372	2,129	26,013
Aug.	58,055	53,203	2,929	26,071
Sept.	60,771	55,221	2,729	26,527
Oct.	58,249	52,861	2,316	23,634
Nov.	61,818	56,669	2,811	23,625
Dec.	63,873	58,291	3,086	23,435
Total	725,318	654,444	37,311	.....
1950				
Jan.	65,585	58,878	3,440	25,216
Feb.	67,029	60,257	3,626	26,923
Mar.	80,442	71,876	4,693	27,631

Magnesium

(Thousands of pounds)

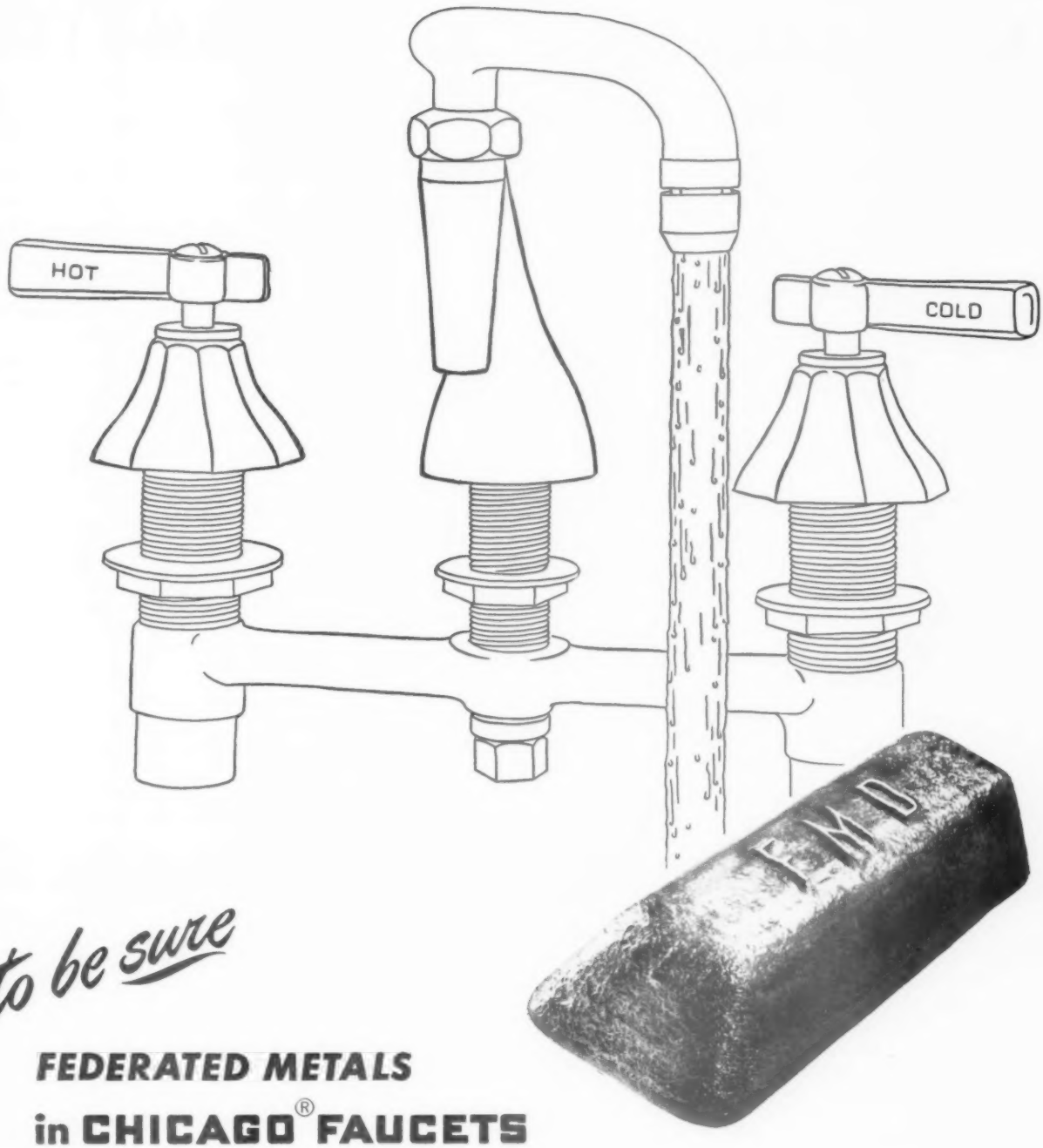
	Shipments: Total	Shipments: For Sale	Unfilled *Orders
1948			
Total	8,214	7,488	....
1949			
Feb.	813	756	3,586
Mar.	879	800	3,227
Apr.	726	669	3,234
May	778	726	2,885
June	799	759	3,025
July	689	637	3,073
Aug.	753	712	3,107
Sept.	727	691	3,015
Oct.	796	763	3,050
Nov.	801	769	2,399
Dec.	781	738	2,216
Total	9,364	8,781	....
1950			
Jan.	814	762	2,237
Feb.	735	676	2,218
Mar.	903	849	2,322

* For sale only.

Aluminum

(Thousands of pounds)

	Shipments: Total	Shipments: Sand	Shipments: Perm. Mold	Shipments: Die	Unfilled *Orders
1948					
Total	424,490	139,781	161,334	118,738	.....
1949					
Feb.	27,228	9,286	9,339	7,795	52,916
Mar.	27,478	9,348	9,386	7,999	50,508
Apr.	23,801	8,041	8,353	6,876	45,638
May	21,392	7,582	7,293	5,994	41,460
June	23,261	8,668	7,790	6,257	38,159
July	18,621	6,311	6,592	5,180	36,993
Aug.	23,997	9,048	8,326	6,119	38,130
Sept.	27,546	9,923	9,491	7,623	38,179
Oct.	29,071	9,634	9,923	8,908	37,881
Nov.	26,317	9,212	8,315	8,348	36,846
Dec.	26,762	10,070	7,714	8,430	36,921
Total	304,616	106,825	102,908	88,019	.....
1950					
Jan.	28,801	9,646	9,400	9,052	40,591
Feb.	28,887	10,171	9,358	8,851	44,235
Mar.	35,845	13,035	11,094	10,870	47,350



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NATIONAL OPEN HEARTH COMMITTEE

Holds Anniversary Conference

By EDWIN BREMER
Metallurgical Editor
THE FOUNDRY

MORE than 1200 members and guests attended the silver anniversary conference of the National Open Hearth Committee, American Institute of Mining and Metallurgical Engineers, held at the Netherland Plaza hotel, Cincinnati, on April 10 to 12. At the annual fellowship dinner held Tuesday night, April 11, an award with certificate was made to Charles Fon Dersmith, Armco Steel Corp., Middletown, O., in recognition of his long and active service in behalf of the committee. W. A. Greene, Kaiser Steel Corp., Fontana, Calif., was presented with the McKune award of $200 for his paper "Effect of Hot Metal on Openhearth Production". Announcement was made that H. M. Griffith, Steel Co. of Canada, Hamilton, Ont., was elected chairman of the National Open Hearth Committee, and that next year's conference will be held in Cleveland on April 2 to 4. Principal speaker at the dinner was W. W. Sebald, Armco Steel Corp.

First session on acid openhearth operations held Tuesday morning was under the direction of T. D. Collins, Mackintosh-Hemphill Co., Midland, Pa., and E. E. Callinan, Baldwin Locomotive Works, Burnham, Pa. The first paper by Kenneth Midlan and Charles Funk, American Locomotive Co., Latrobe, Pa., related to a "Study of the Physical Characteristics of Open Hearth Slags". The authors separated slags into six classifications differing in appearance, silica content, fluidity, and FeO content. For example, type A slag contained 45 to 53 per cent SiO_2, had a fluidity range of 6½ to 13, an FeO content of 29 to 38 per cent, and on fracture showed a striated appearance. Type D contained 54 to 56 per cent SiO_2, a fluidity of 3 to 7, an FeO content from 8 to 26 per cent, and a granular appearance while the remaining type F had a silica content of 54 to 58 per cent, a fluidity of 2½ to 3½, and an FeO content of 5 to 20 per cent.

C. F. Christofer, Continental Foundry & Machine Co., East Chicago, Ind., in discussing steel making, pointed out that steels in the range 0.10 to 0.40 per cent C had a tendency to produce solid globular silicate inclusions; those with 0.40 to 1.20 per cent C tend to show liquid sulphide inclusions around the grain boundaries while those with 1.20 to 1.80 per cent C show type III widely separated sulphide inclusions. According to Mr. Christofer addition of a small amount of aluminum to the 0.10 to 0.40 per cent steels tends to produce type II inclusions or the liquid sulphide around the grain boundaries while a large amount of aluminum changes the inclusions to type III. Likewise an addition of a small amount of aluminum to the 0.40 to 1.20 per cent C steels changes the type II inclusions to type III.

Second session held Tuesday afternoon with H. M. Parker, Armco Steel Corp., Butler, Pa., and R. C. Solomon, Granite City Steel Co., Granite City, Ill., presiding, related to a number of phases on cold metal practice and the basic foundry. Substitutes for pig iron were discussed by several including G. S. Baldwin, Standard Steel Works, Burnham, Pa., Clyde Jenni, General Steel Castings Corp., Eddystone, Pa., and Mr. Solomon. Mr. Baldwin stated that his firm obtained good results with natural gas coke in small granules which was placed in the middle of the charge and covered with turnings or other fine material. Mr. Jenni described use of graphite which was placed on top of the lime and covered with scrap. Practice is to use 14 per cent pig iron, 5 per cent cast iron scrap, 14 lb graphite per ton of charge, and remainder steel scrap. Mr. Solomon pointed out that use of substitutes depended upon the price differential between pig and scrap, metallurgical availability and effect on production.

R. L. Baldwin, Stanley Works, Bridgeport, Conn., described practice in his plant using cupolas as the source of hot metal for the openhearth furnace. Two cupolas are used alternately and operate 72 to 80 hr. They are lined to 54 in. inside diam, and produce 5500 tons of hot metal per month. Front slagging spouts are used, and the slag is disposed of by the wet method. Skip-hoist charging is employed, and the charges are composed of 35 per cent cast iron scrap and 65 per cent steel scrap. Metal charges weigh 3000 lb, coke splits 550 lb, and 60 to 70 lb of limestone is used per charge for slag formation. Cupolas melt at the rate of 10 to 12 tons per hr.

E. H. Reyer, Keystone Steel & Wire Co., Peoria, Ill., in discussing use of oxygen for carbon reduction and temperature pick up said that addition of 450 cu ft of oxygen per minute through a 1-in. pipe provided higher tonnages as well as a reduction of 5 to 10 points in sulphur content. F. Von Grueninger and W. D. Lawther, American Steel Foundries, Granite City, Ill., described bath temperature control through use of an immersion type pyrometer. That method they pointed out gave concordant results, and different values as compared to the optical type. Through study of castings poured it was determined that a tapping temperature of 2920° F into the ladle was satisfactory for the type of castings being poured, and the decrease in temperature enabled a reduction in the amount of oil consumption at the furnaces.

Wednesday morning session on basic open hearth quality and metallurgy had for chairmen F. M. Washburn, Wisconsin Steel Works, Chicago, and C. R. Taylor, Armco Steel Corp., Middletown, O. N. J. Grant, Massachusetts Institute of Technology, Cambridge, Mass., indicated that the presence of 5 to 6 parts per million of atomic hydrogen in steel reduced elongation and reduction of area down to 20 per cent. He also pointed out that with high strain rates in testing that effect of hydrogen does not often appear. Also if the steel is allowed to age, the hydrogen tends to escape through diffusion. Samuel Epstein, Bethlehem Steel Co., Bethlehem, Pa., discussed use of vanadium in producing non-aging rimmed steels, and said that use of 1 lb per ton gave a good surface, much better than when the steel is killed with aluminum alone. Cost is about $4.50 a ton of finished product, and is applicable where surface quality is a requirement.

An interesting motion picture was shown by T. E. Brower, U. S. Steel Corp., Pittsburgh, and J. W. Bain and B. M. Larsen, U. S. Steel Corp., Kearny, N. J., to exhibit turbulent flow in water and in molten steel streams. According to the authors turbulence in liquid steel streams causes a loss in manganese, silicon and chromium. by decreasing height of stream fall, and improving the shape of the stream to reduce turbulence, it is possible to save from 0.5 to 1 lb per ton of steel of manganese as well as a saving in silicon and chromium.

This No. 404 Clearfield Mixer has been in operation for eight years in the core shop of the Railway and Industrial Engineering Co. of Greensburg, Pa., makers of electrical switchgear for substations and generating stations. During that time it has required only very few minor repairs and "has paid for itself many times over."

in preparation of foundry sand

The

CLEARFIELD mixer

"Pays For Itself Many Times Over"

By its speed, its dependability, its flexibility—by the high quality sand it turns out—the Clearfield Mixer cuts costs and speeds production. In the unsolicited words of one of our satisfied customers "it pays for itself many times over."

Clearfield Mixers, featuring the famous revolving pan principle, are available in a wide range of sizes. There is a Clearfield Mixer to meet any sand preparation requirement you have, either as a single process or part of an integrated system.

Write today for Catalog No. 79
for complete details.

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MIXER
MIXES, TEMPERS
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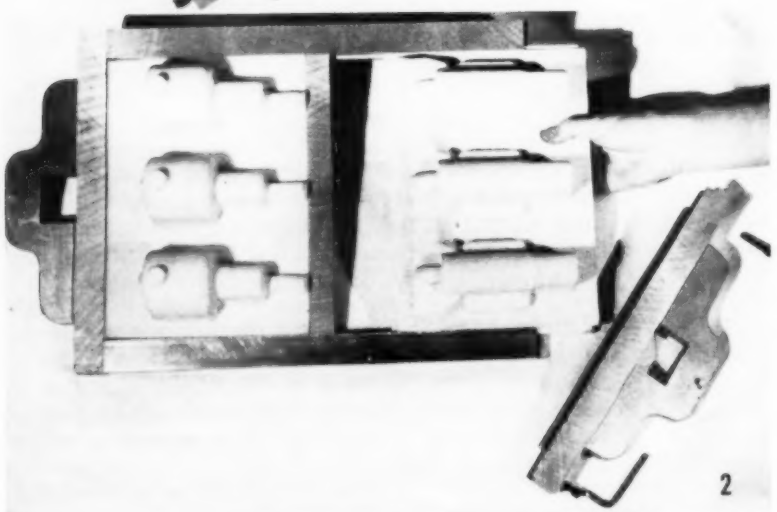
MATCHPLATE FRAMES

Facilitate Loose Pattern Work

1



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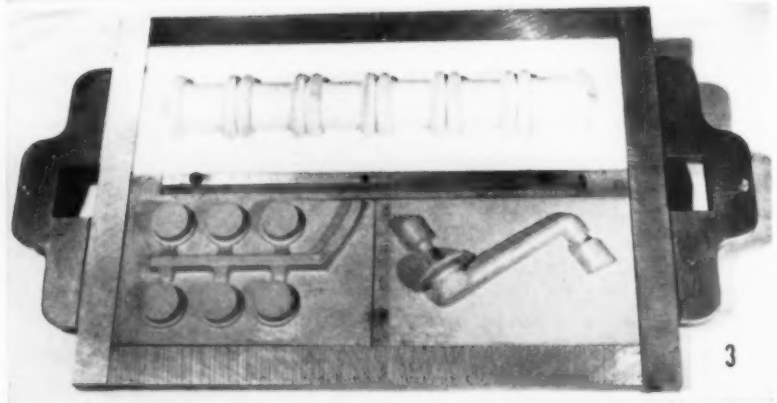


3

A NEW development designed to increase foundry output involves the use of production pattern equipment in the form of interfitting matchplates. A product of Efficiency Match Plate Co., 4013 North Richmond St., Chicago 18, it consists of interchangeable matchplate sectional frames of cast aluminum with parallel sides and ends. The frames may include longitudinal and transverse dividers, or may be used without dividers to hold a full size matchplate. This sectional frame is shown dismantled in Fig. 1.

Interior of the frame is tongued and grooved to insure rigid and tight interfitting complemental plastic matchplate sections of which there may be one, two or more (depending upon size) as shown in Figs. 2 and 3. To enable easy insertion and removal of these plastic matchplate sections, the frame is constructed sectionally and assembled with screws as shown in Fig. 1. Longitudinal or transverse divider bars are used to insure different arrangements and combinations of sections.

Different types of sectional plastic matchplates can be inserted into the frame. These may involve quarter sections, longitudinal half sections, transverse half sections, full sized matchplates or a combination of these different sections. Less than one minute is required to make insertion or removals or substitutions to provide different combinations.

Plastic or other composition matchplates are said to offer durability and smoothness of surface, and resistance to water, oils, acids and sand abrasion. Brass processing frames, adjustable to quarter, half and full sized sections, have also been developed for

(*Concluded on page* 174)

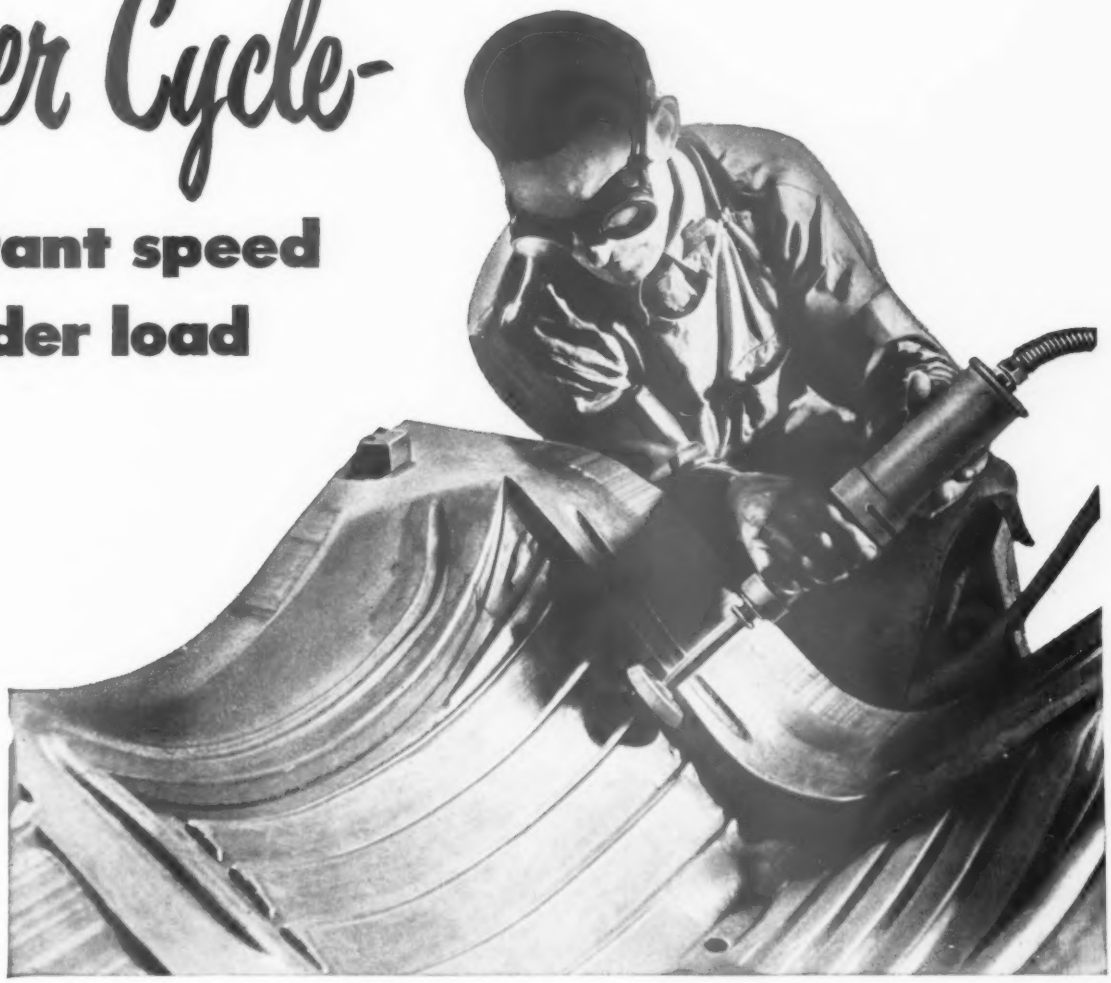
Fig. 1 — Aluminum sectional matchplate retainer frame with component parts disassembled

Fig. 2 — Frame with transverse divider and two matchplate half sections being assembled

Fig. 3—This frame with longitudinal divider accommodates two quarter and one half sections

Super Cycle-

constant speed under load

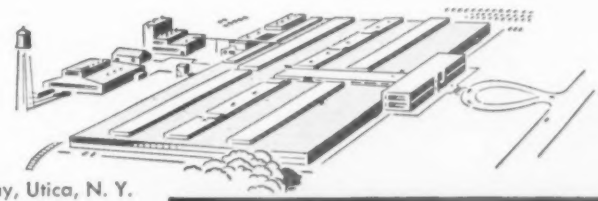


The CP Super Cycle Grinder gives more output per man-hour than any other type of portable grinder, because

- maintains cutting speed under load.
- more power per pound than any other type of portable tool.
- operating speed remains constant throughout life of tool.
- low maintenance cost . . . no brushes to replace . . . no armature to burn out.

All Super Cycle Grinders have squirrel cage induction type motor; 360 cycle, 3-phase, 220 volt current. Straight grinders have 4", 6" and 8" wheels, or wire brushes. Angle grinders have 6" cup wheels; angle sanders, 7" and 9" pads.

Write for copy of Catalog 905-2.



With its half million square feet of floor space, Chicago Pneumatic's new Utica unit is the world's most modern plant for the production of pneumatic and electric tools.

Chicago Pneumatic Tool Company, Utica, N. Y.

CHICAGO PNEUMATIC TOOL COMPANY

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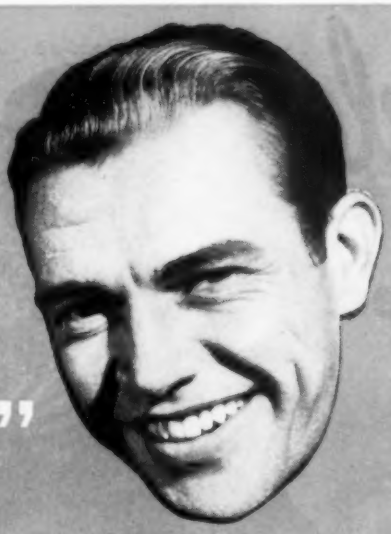

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"CERTIFIED"

is the best abrasive

As Purchasing Agent I have to see that the abrasive we use is the most economical. This means a hard, slow wearing abrasive like "Certified" . . . one that can be used over and over. An abrasive that does a good job in the cleaning room . . . one that gets castings really clean in a hurry.

"CERTIFIED" IS TOPS! Each grain of Samson Shot and Angular Grit is a solid homogenous mass that wears slowly, lasts longer for top-efficiency blast cleaning at lowest cost. "Certified's" special automatically controlled hardening process gives 'em plenty of extra hardness for cleaner castings. Order "Certified" today for faster, better, cheaper blast cleaning.

Always specify "Certified"

PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PENNA.

STEEL SHOT AND GRIT CO.
BOSTON, MASS.

(*Concluded from page* 172)

use by the plastic pattern matchplate maker in casting these unframed sectional or full size plastic matchplates. With these processing frames the patternmaker is able to cast plastic patterns which are complemental in size to the frame described here. One of the advantages of the frame is that the plastic matchplate does not adhere to it, thereby reducing stress and strain and consequently eliminating cracking. The frame can be used for all matchplates specially made to be interfitting and complemental to each other and the frame.

The user requires only one frame for the quarter and longitudinal half section, and one for the transverse half section. This equipment, which is made for the standard 12 x 18 flask or for any special flask sizes desired, is adapted to quantity production of a wide variety of loose pattern work. Its use is being licensed to matchplate makers and foundries under pending patent applications.

Negro Students Get Summer Job Rights

Through the offorts of the National Urban League's pilot placement project, and co-operation of the Foundry Educational Foundation and Howard University, Washington, technically trained negro students this year will have an opportunity to gain summer work experience on skilled jobs in the foundry industry. The Urban League is a nation-wide interracial social service agency which promotes equal economic opportunity for all.

Book Review

Symposium on Metallography in Color, 63 pages, 6 x 9 in., published by the American Society for Testing Materials, Philadelphia 3. Price $4.50.

Presented at a recent annual meeting of the society, this symposium has just become available in printed form. Illustrated with ten four-color process insert plates, the book contains six papers relating to metallography in color. Those include "Metallography in Color" by R. P. Loveland; "Microscopic Optics for Color Metallography" by James R. Benford; "Quality and Quantity of Illumination in Color Metallography" by R. P. Loveland; "Color Metallography Simplified" by Mason Clogg Jr.; "Some Applications of Color Metallography" by W. D. Forgeng, and the "Application of Color Photography to the Study of Nonmetallic Inclusions" by A. M. Hall and E. E. Fletcher.

Speedy handling of sand, molds and castings is very important to meet production demands. Jeffrey has the equipment — flask fillers, mold conveyors, aerators, crushers, screens, feeders — to do a complete mechanization job. It will help you broaden the profit margin all along the line. Quality equipment for quality castings.

Photo courtesy Production Foundries Division of Jackson Industries, Inc., Birmingham, Ala.

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

907 North Fourth St., Columbus 16, Ohio

Baltimore 1 · Birmingham 3 · Boston 16 · Buffalo 2 · Chicago 1 · Cincinnati 2 · Cleveland 13 · Denver 2 · Detroit 13 · Harlan · Houston 5 · Huntington 19 · Jacksonville · Milwaukee · New York 7 · Philadelphia 3 · Pittsburgh 22 · St. Louis 3 · Salt Lake City 1 · Scranton 3

Complete Line of Material Handling, Processing and Mining Equipment

Adventures of BILL

By PAT DWYER
Drawings by RICHEY

AT THIS time of the year," Bill said, "well, also at other times, I often think I made a mistake when I entered the foundry. When I look around and notice all the downy birds knocking down gobs of easy money while contributing practically nothing in the way of time and effort, I am moved almost to tears."

"Well," I said, "I should not be surprised to hear you weeping and wailing in the winter season with the air filled, and with the ground covered with hail, rain, sleet and snow and with the cruel frost nipping your long red nose. A gloomy attitude has no place in the present jocund summer season, with the jolly old sun shining overhead, air filled with twittering of birds, life-giving ozone, and with trees, bushes and flowers bursting forth in the annual miracle of rejuvenation. Just for the sake of the argument—and I have a sneaking presentiment there is some kind of an argument brewing in the old top knot—which of the almost innumerable openings would you dart into of you were young and nimble enough to take up a career that seemed to point to fame and fortune?"

"I am not thinking so much of the fame and fortune angle, although of course these factors have a certain, if minor place in the general situation. I am thinking more particularly of a job requiring neither mental nor physical effort. One which would not send me to bed with a headache at night, or wake up with a worse headache in the morning. I am tired of this treadmill, come day, go day, God send Sunday form of existence."

"My dear young fella, by a curious coincidence I have the complete solution to your problem."

"Sez you!"

"Yes, sez me. While doing a bit of miscellaneous browsing through the public library the other day, I came across a most remarkable book."

"I don't see anything remarkable in that. In any collection of several million books, there is bound to be at least one that is remarkable. However, if you intend to go a little deeper into the subject, and I can see by the Ancient Mariner glitter in your eye, you do intend to dive a little deeper, I shall be the goat, the sacrificial goat and listen with more or less attention while you build up the fire and touch 'er off. I don't think anything could be fairer or more aboveboard than that. Shoot if you must this old gray head, but for the love o' Pete, cut it short, she said. A rather neat poetic touch, if I do say so!"

"Neat," I admitted, "but hardly gaudy enough to rate you among the immortals, or even the lads who write the radio jingles, or supply last words in the limerick contests which win the fur-lined washboard or the self-taught key bugle which makes the music go round and round."

"Jealousy," Bill begged to point out, "is a terrible affliction."

"I know several other afflictions that are more grievous, including the rankest kind of ingratitude. Here I am ready and willing and, I might add with all due modesty, able to solve the problem that is causing you to bite your nails and what gratitude or co-operation do I get from the party of the second part? Absolutely none. To get right down to brass tacks, do you or do you not want to hear about this book I found in the public library?"

"To be perfectly frank and honest, the answer is NO. However, if you cannot eat or sleep while the item is festering in your mind, I shall, as I already have admitted, be the goat with the listening ears."

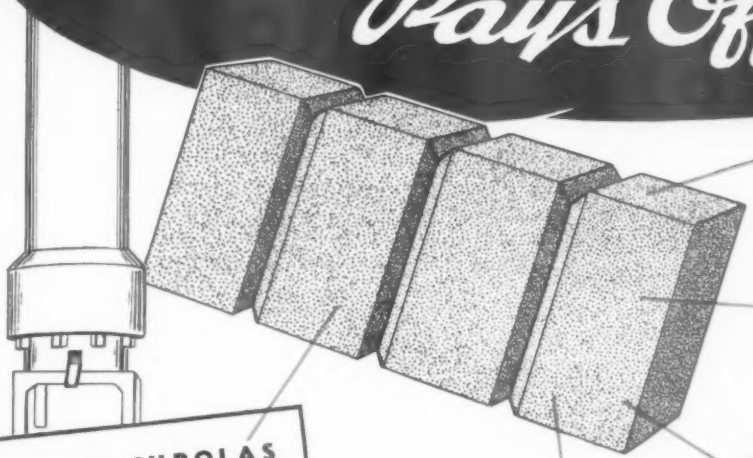
"If it does not require too much effort kindly keep them cocked in this general direction. In this book, *Our Wonderland of Bureaucracy,* the author, James M. Beck, former solicitor-general of the United States, shows how bureaus grow and bureaucrats wax fat by sketching the history of an imaginary Federal Mortuary Bureau."

"A very good man. I heard him make a speech at the banquet which marked the close of the American Foundrymen's Association convention in Philadelphia in 1919. I was not particularly impressed with the subject, but I was greatly pleased with the oratorical presentation."

(*Continued on page* 178)

"Better make it two, Unc, 'cause one doesn't go far these days"

From Many Angles ...the use of Famous CORNELL CUPOLA FLUX Pays Off!



Cleanses molten iron so that you pour improved castings and reduce scrap loss.

Makes iron more fluid, greatly reduces sulphur and keeps slag fluid.

Reduction of chilled sides, hollow centers and hard spots in castings makes machining easier.

KEEPS CUPOLAS CLEANER AND REDUCES MAINTENANCE. Drops are cleaner, bridging over is practically eliminated, and there is less erosion of brick or stone lining.

Practically no labor is required in using, due to EXCLUSIVE SCORED BRICK FORM. It takes but a few seconds to lift Famous Cornell Flux out of container and toss it into cupola with each ton charge of iron, or break off one to three briquettes (quarter sections) for smaller charges, as per instructions.

MALLEABLE FOUNDRIES, where there is cupola operation, are rapidly turning to Famous Cornell Cupola Flux —to give their castings a better start and reduce cupola maintenance.

FAMOUS CORNELL CUPOLA FLUX IS BACKED BY OVER THIRTY-TWO YEARS' SUCCESS IN CASTING IMPROVEMENT.

Many leading foundries are regular users.

Write for Bulletin No. 46-B

Famous CORNELL ALUMINUM FLUX

CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

The CLEVELAND FLUX Co.

1026-1040 MAIN AVENUE, N. W.
CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum Flux Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

Famous CORNELL BRASS FLUX

CLEANSES MOLTEN BRASS even when dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves you considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

(*Continued from page* 176)

"In that case you will be pleased with the manner in which he covers the subject of bureaus and bureaucrats. As they say over in Pennsylvania, Give a listen vunce:

A mortician, feeling that his calling has been neglected, enlists the aid of a friendly congressman and an appropriation of $25,000 for the study of sanitary interments. Lo! A bureau is born and soon the solicitous mortician, or some person who needs a job, is United States Chief Mortician. He appoints a first and second assistant Chief Mortician and a secretary for each of these exalted functionaries, and at least three stenographers and a messenger.

Then an appropriation is put through for research. A scientist starts a study of post-mortem changes in the human cadaver. Two others go to Europe to investigate methods of burial, ancient and modern. Soon it is plain that investigations must be made of the best materials for coffins, and the claims of marble and granite for headstones.

It isn't finished yet. The bureau gets an appropriation for federal aid to such states as adopt the United States Standard Burial Code.

Then the Chief Mortician—swollen with the pride of office—employs the radio for a 20-minute nation-wide broadcast in which, after some orchestra music and a song by an expert crooner, the Chief Mortician implores the people of the United States to enlist in the great crusade whose slogan is:

More And Better Funerals
If, Eventually, Why Not Now?

Each year the appropriations grow and each year the activities of the bureau expand.

"Well," Bill said, "I'll tell you. Bro. Beck has made out a very good case, showing how the grafters, parasites, chiselers and barnacles become attached to the good old easy-going ship of state. Once they get a good grip, all the king's horses and all the king's men could not pry them loose. The most discouraging feature in the whole situation is that while the practice usually is condemned publicly, it is approved privately to an alarming extent. Too many individual voters secretly hope that some day the lightning will strike and land them on the gov'mint payroll, preferably in a job where a much lower paid deputy can do all the work—if any—that is to be done. Looking at it up and down, catty corner and across the middle, maybe I had better stick to my own racket."

"'Tis a holy and a wholesome thought. Any inquiries recently from the boys out on the firing line?"

"I had an inquiry the other day from a man who wrote that he had no trouble with the smaller cores, but the blacking raises on the large cores, 18 to 24 in. thick, 6 ft in length and 4 to 5 ft high. The core sand mixture contains 140 qt No. 50 silica sand, 1½ qt linseed base core oil, 2 qt cereal binder, 4 qt silica flour, 1 qt mineral base binder. Sand and dry ingredients are mulled and then the oil and water are added. The cores are baked from 4 to 8 p.m. Then the heat is shut off and the cores are allowed to soak until 7 a.m. when they are removed and sprayed with a blacking mixture containing 50 per cent plumbago, 35 to 40 Be. They are then returned to oven and baked for 4 hours. In the inquirer's opinion the cores are blacked too soon. Steam from the cracks lifts the blacking and forms a shell causing the blacking to separate from the core surface. The molten iron floats the blacking away to produce defective areas on the surface of the casting. He has tried a blacking mixture—1 part bentonite, 4 parts plumbago, and thinned with a proprietary binder derived from wood pulp. This did not show any improvement. No trouble is experienced with blacking on molds, dried or skin dried.

"Basing an opinion on the evidence submitted, I wrote that I was inclined to agree with his diagnosis. Since the blacking is satisfactory on small cores

(*Continued on page* 180)

JOB TESTED
GRINDING
EFFICIENCY
WITH
Stearns

TIME-SAVER
GRINDER
HOLDING
MAGNETS

YES, here's the answer to new grinding efficiency. Use the STEARNS Grinder Holding Magnet — cut your grinding costs by reducing the set-up time and the grinding time. This means more production, too, for more work is done per man-hour. Easy to install and simple to operate, the STEARNS Grinder Holding Magnet holds all shapes of castings securely and safely. Eliminates the need for clamps, wedges and other devices normally needed for grinding castings.

Using STEARNS Grinder Holding Magnets means savings in dollars and hours, a saving in worker fatigue, and a definite improvement in safety practice.

- CUTS COSTS — Reduces production costs up to 30%.
- SAVES TIME — Less time required for chucking up.
- SAVES LABOR — Casting finished in less time.
- SPEEDS PRODUCTION —Production increases of 20% or more.
- ECONOMICAL — Low operating and maintenance costs.
- RUGGED — Sturdily constructed — made for tough work.

Stationary and tilting models available in three sizes: 16" x 14", 16" x 24", 16" x 40".

Stearns MAGNETIC MANUFACTURING CO.

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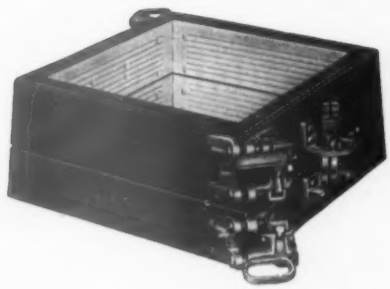
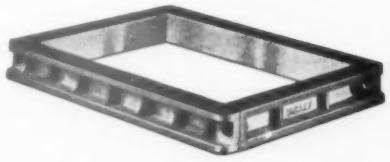
Adams 12"-38"
Jolt Squeezer
Portable Type

ADAMS
MOLDING MACHINES and CUSTOM-BUILT FLASK EQUIPMENT





HERE are the "Partners" that keep production rolling and costs low . . . help you meet today's increasing competition with *faster* production of *better* castings at lower cost.

Adams Molding Machines are designed by experienced foundrymen to solve your production problems . . . to give you the speed, power and durability for consistently large output day after day. Close control of jolting and squeezing operations means accurate, uniform molds. Smooth, easy operation, with minimum working parts, simplifies operation and maintains steady, high output levels.

Adams Flasks are custom built to your exact specifications for superior performance and economical production.

Get these "Partners" on your production team now! Write for full information. THE ADAMS COMPANY, 700 Foster Street, Dubuque, Iowa.

The ADAMS Company

ESTABLISHED 1883

DUBUQUE, IOWA, U.S.A.

MOLDING MACHINES and FLASK EQUIPMENT

(*Continued from page* 178)

and on the molds, it is reasonable to assume that the blacking in itself is not responsible for the trouble with the large cores. One naturally assumes that the core and the baking method require a bit of looking into. A suspicion that steam is developed in the core during the second baking period seems to indicate that the core is not dried thoroughly in the first trip through the oven. If this is the case, the remedy is obvious."

A core surrounded by molten metal cannot be compared to a dry or skin-dried mold. In the skin-dried mold the face is dried to a depth of approximately 1 in. In some cases it is dried to a greater depth. The 1-in. depth usually is sufficient because any steam developed back of the dried sand layer will find exit through the sand in the body of the mold. In a properly dried mold the steam is not a factor, because none is present. In a core completely or almost completely surrounded by molten metal, the conditions are different. Instead of devoting entire attention to the composition of the sand mixture and the blackwash, the first point of investigation should be the condition of the core. Several test holes about 1 in. diameter and extending from the outside to the center facilitate the examination. If a small rod inserted in one or more of these holes shows the faintest trace of moisture condensed on the surface, the core is not dry and should be given another pass through the oven. The test is similar to the housewife's test when she sticks a straw from the broom into a cake in the oven.

Possibly the method of constructing the core may be a factor in the problem. The same may be said of the core sand and blackwash mixtures. The comment may not apply in this particular instance, but in many instances these items represent heredi-

The browser's favorite occupation

tary influence rather than direct personal discovery. In my opinion the core sand mixture is unnecessarily elaborate. With a cast iron arbor—if an arbor may be used—or a number of rods or steel pipes disposed skilfully, the mineral base and cereal binders may be omitted. Their principal function is to increase the green strength. With proper and ample reinforcement, this feature is not on the prominent list. The silica flour comes in the same category. The material is used quite freely in steel foundry practice, but except under extraordinary conditions, including iron considerably higher in temperature than usually encountered, no silica flour is needed in the core sand mixtures for iron castings.

Instead of continuing in generalities which may or may not apply to this case, perhaps it would be more advisable to outline briefly the methods employed in several prominent gray iron foundries in the construc-

(*Concluded on page* 182)

"These Plates sure Speed Production"

TRANSITE CORE PLATES are lighter, stronger, resist warpage

Core makers can handle more Transite* Core Plates at one time, thus make fewer trips. That means faster production with less fatigue and fewer accidents. Transite Core Plates offer all these advantages:

They Last Longer—Made of fibrous asbestos and cement, Transite Core Plates resist shock . . . are less likely to crack or break.

They Clean Easily—Core wash, sand, etc., do not stick as readily as to other materials. Both sides are usable.

They resist Corrosion and Warpage—Transite Core Plate surfaces stay smooth even after long service. Warpage is less than 0.1%.

They are Economical—Low price, low maintenance and long life add up to low cost.

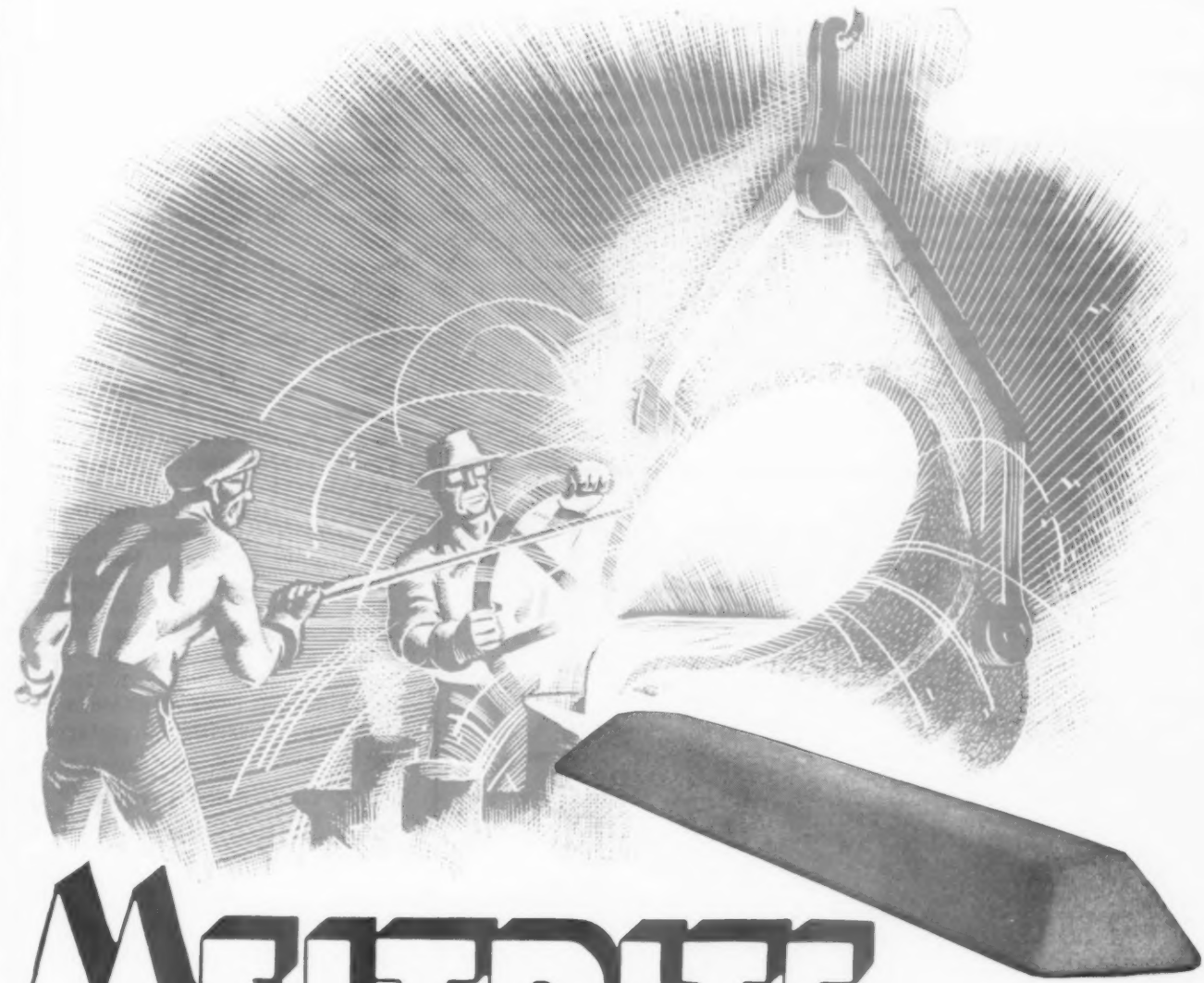
To eliminate green cores and reduce baking time perforated core plates are also available.

For full details, write Johns-Manville, Box 290, New York 16, N. Y.

JOHNS MANVILLE JM PRODUCTS

*Reg. U. S. Pat. Off.

Johns-Manville TRANSITE CORE PLATES MADE OF ASBESTOS



MERRITE
PIG IRON

LIVING UP TO ITS NAME

MORE USED THAN ANY OTHER MERCHANT PIG IRON

SIXTY-SEVEN YEARS OF
SERVICE TO INDUSTRY

PICKANDS MATHER & COMPANY
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(*Concluded from page* 180)

tion of medium and large cores.

Many cores, particularly large cores and cores from which the vent can escape freely, are made from a coarse bank sand bonded with a pitch base binder, or in fact with practically any type of binder. This is an economic rather than an operating factor. Another sand similar to the sand in this case is bonded with oil. Through the absence of a clay bond this sand is more refractory than the other. The inside of the corebox is lined with the highly refractory sand and the remainder of the box is rammed full of the ordinary sand. Layers of coke are incorporated at each ramming and are connected at various points. Passages from the coke layers lead to the core prints on which the core is supported in the mold. Additional and adequate passages are provided to conduct the vent gas from the core to the atmosphere outside the flask, or the pit in which the mold is made. The core is sprayed, swabbed, or brushed with blacking while still green. A second blacking is not necessary.

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Brake Drum Materials

(*Continued from page* 69)

this table, it becomes obvious that no single metal has all the desirable physical requirements listed, and it becomes necessary to compromise on one property to take advantage of another. Ultimately every brake drum becomes a well engineered compromise.

Since pure metals have not been found applicable for brake drums, we have resorted to alloys of the more common metals. We know that the mechanical properties are enhanced by alloying to our advantage but that the physical properties show a disadvantage in most cases. For example, thermal conductivity—probably the most important physical property in a suitable brake drum material — immediately decreases when one pure metal is added to another whether as an alloy or incidental as an impurity. This effect is shown for iron in Fig. 1. Note in particular the effect of silicon, which is common in variable percentages to all iron alloys.

Conductivity Decreases

Fig. 2 shows the decrease in thermal conductivity as the temperature increases of pure iron, wrought iron, eutectoid steel and two quite similar high total carbon cast irons. Of considerable interest is the fact that the high-carbon cast iron approaches the conductivity of pure iron at 500°C, which unquestionably is in the range of the friction surface temperature developed many times during the life of a drum.

Table II shows the physical properties of alloys of the pure metals shown in Table I. In making up these tables, two different temperatures or two different temperature ranges were selected to show the complications one can get into in any attempt to make theoretical calculations on what goes on in a brake drum in performing its function of deceleration.

Thermal capacity, as shown in the last column, is the product of specific heat times the density in order to show the unit volume capacity for storing heat. For example, aluminum has twice the specific heat of cast iron but only about one-third the density. Therefore, it would require 1½ cu in. of aluminum to store the same quantity of heat as could be stored in 1 cu in. of iron.

Under standard conditions of steady heat flow, our existing data and formulas are adequate, but, for the conditions of unsteady heat flow as

in brake applications, there seems to be a big void in data. Furthermore, there seems to be a lack of data in the physical properties of materials in the temperature ranges encountered in brake drums. As a consequence, we are forced to resort to actual testing to prove designs and materials rather than to theoretical calculations.

In April, 1938, A. S. Van Halteren[3] of Motor Wheel Corp. presented a paper at the Detroit Section meeting, entitled "Fundamentals of Heat Transmission Applied to Automotive Brakes," in which he proves mathematically the reasons for some of the requirements just mentioned and concludes, "We have much to learn in connection with brake heat transmission problems. However, much can be accomplished by promoting an understanding of these problems and by suggesting compromises in appearance and comfort when there is an opportunity to contribute toward safety."

Cites Future Work

Last year, Ralph K. Super[4] of Timken-Detroit Axle Co. in his paper, "Heavy Duty Brakes—What's New," presented before the West Coast Section, pointed out: "This review of brake progress for large vehicles indicates that much work in the future must be concentrated on (1) Control systems having the ultimate objective of automatic power distribution to compensate for load variations, (2) Lining and brake drum materials having improved performance at the higher brake temperatures, (3) Improved cooling of wheel brakes to increase their present capacity, (4) The expanded use of auxiliary brakes to supplement the wheel brakes, (5) The development of adjusting mechanisms for heavy duty brakes which will automatically maintain lining - drum clearance."

More recently C. E. Stevens of the Al-Fin Division of Fairchild Engine & Airplane Corp. presented a paper before the National West Coast meeting on the "Design and Development Considerations of a Bi - metallic Brake Drum." He said: "The results of all testing so far lead to one conclusion; namely, where cooling air is available, the bimetallic drum will out-perform the standard all cast iron construction; when cooling air is not available, then the use of this drum, except in the case of squeal elimination, is of dubious advantage."

These conclusions by recognized investigators, and many others could be included, are cited to stress the magnitude of the heat problem and to amplify the necessity for a better understanding of the physical properties of materials under existing operating conditions.

The aircraft industry has made real strides in solving some of their brake problems. Prior to the war, energy inputs and brake drum designs pretty much followed those of road vehicles, but as planes became larger and landing speeds higher their problems multiplied. Table III[5] was prepared to show this improvement and to compare present practice in the aircraft industry with that of the automotive industry. Whether these comparisons are justified is a matter of opinion but they do show what has been accomplished through use of better materials and improved designs.

It should be pointed out that the drums listed under planes are bimetallic "centrifused" drums produced by Motor Wheel Corp. From the standpoints of physics, metallurgy and mechanics, the combination of a cast iron friction face with an outer ring of steel intimately bonded seems to aproach the requirements of an ideal brake drum to a greater extent than anything suggested or tried to

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date. Here we have a working face which can be alloyed to meet the physical and metallurgical requirements backed up by a material that meets the mechanical requirements.

Let us now consider some of the metallurgical factors that lead to compromises in arriving at the most suitable brake drum material. Two factors appear to contribute to the causes of wear, scoring and heat checking in ferrous alloys. These are structural instability and phase change. For instance, if it were possible to stabilize the structural components in a gray cast iron in the form of a lamellar pearlite matrix embedded with uniformly distributed graphite flakes, we would be close to an ideal material. This goal has been sought and much improvement has been made since the universal adoption by the automotive industry of cast iron as a drum material. In 1932, F. L. Main[6] presented a paper before SAE on "Brake Drum Metallurgy" in which he said: "No matter what types of drum and lining best meet the needs of a given chassis, a ferrous braking surface can be secured that has a grain structure suitable for its requirements. Under present conditions of brake operation, a drum surface composed principally of laminated pearlite should prevent difficulties from scoring."

It was just prior to this time that steel stampings, steel castings and malleable iron were replaced by cast iron because of its better resistance to wear and scoring.

With respect to phase change Crosby and Timmons[7] made this comment in their article in THE FOUNDRY, July, 1940 entitled "Metallurgical Aspects of Brake Drums for Heavy Duty Service:"

"It is significant that thermal checking has been observed in metals which undergo no phase changes at all, and in this case, unequal thermal expansion alone is responsible for the crack.

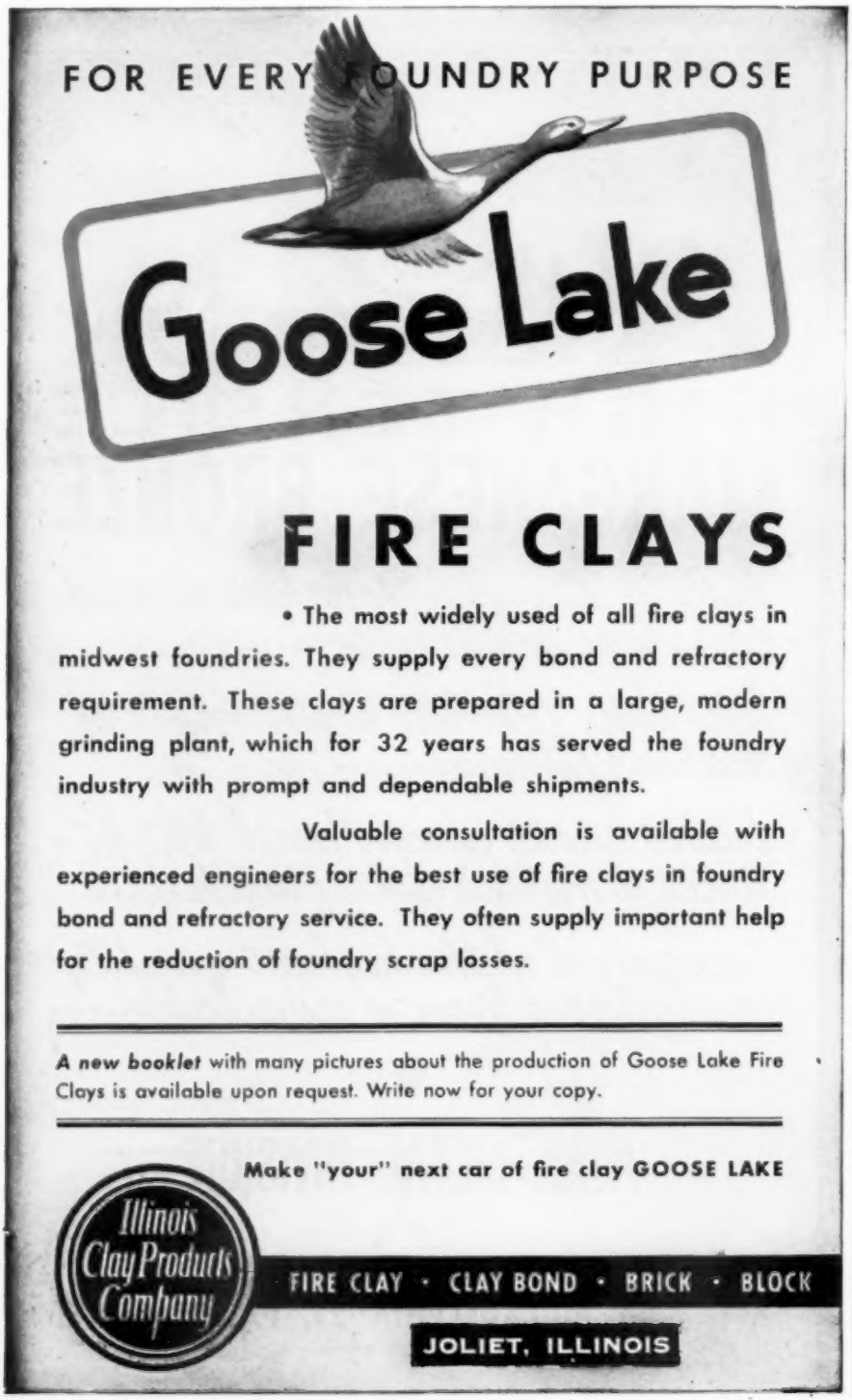
Two Phases Involved

"Almost invariably, however, in the case of ferrous alloys, combination of simple thermal expansion and dimensional changes resulting from passing through the critical range are involved. Volumetric changes occurring in ferrous alloys which exhibit the alpha to gamma transformation are of even larger orders of magnitude per unit rise of temperature than those produced by simple thermal expansion. For that reason effects of allotropic changes should be given adequate consideration in studying thermal checking.

"When iron alloys transform from the body centered cubic lattice to the face centered cubic lattice, an appreciable contraction takes place. During heating, the alpha or body centered iron expands by simple thermal expansion until its critical temperature is reached, at which time a sharp contraction takes place. The gamma or face centered iron formed at the critical range then expands again at a somewhat increased rate (approximately twice that of alpha iron) of thermal expansion. Upon cooling the reverse holds true. Gamma iron cools and contracts until it reaches a temperature at which it will transform to the alpha state, where a sharp expansion takes place followed by contraction of the alpha iron on further cooling.

"When a thin surface layer goes through these volumetric changes, while adjacent layers, because of their lower temperatures, remain practically in their original position, it readily can be seen that a complexity of stresses must be produced which will tend to cause fractures in the thin, heated layer. These frac-

(*Concluded on page* 186)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(*Concluded from page* 184)

tures will appear as fine cracks."

These comments as to why a phase change is undesirable from the standpoint of heat checking are very much in order. However, there may be reasons why a phase change is desirable and makes it possible to tolerate the high rate of heat input without actual melting of the friction face. In passing through the critical range or transforming pearlite into austenite, there is an absorption of heat of approximately 36 Btu's per pound, which is about 9.0 per cent of the total heat required to melt a pound of iron. Since the film affected is relatively thin, we might assume there is a temperature arrest at the transformation temperature in this film which results in a maximum temperature some 225°F lower than would have been reached if the transformation had not taken place.

D. P. Forbes, president of Gunite Foundries Corporation, made these comments on metallurgy in a communication to the author under date of Sept. 27, 1949:

"We have examined many drums returned to us after failure and there is one characteristic in common in nearly all drums which fail from heat checking; every drum shows the presence of martensite or one of its decomposition products on the braking surface. This martensite sometimes extends to a depth of 3/32-in. To form martensite in a brake drum the temperature must be raised above the critical. This is certainly a minimum of 1400°F. It would seem that to penetrate to a depth of 3/32-in. the surface must have reached a temperature in the range of 1600 to 1800°F. (We have encountered cases of incipient fusion on the braking surface which would indicate localized temperatures in excess of 2000°F.)

"We know that there is a volume change when metal passes from pearlite to austenite but this volume change is in the 'right' direction, namely, the volume is smaller so that the compression stresses are slightly relieved. It would appear, therefore, that if the formation of martensite is the cause of heat checks, then the initial fatigue fractures must occur in this brittle material. The theory is not particularly convincing, in view of the fact that martensite probably has a higher fatigue limit than pearlite. On the other hand, the presence of graphite which is, in effect, a minute crack in the metal, may cause fatigue to progress faster in martensite than in the more ductile pearlite.

"We have experimented with some metals in which the critical temperature is sufficiently high to place it out of the temperature range usually encountered in brake service. Heat checks are still encountered in such metal. However, this may be due to a high coefficient of themal expansion and the stresses due to heat may be much greater than in a normal brake drum iron."

(*To be concluded next month*)

References

1. "The Airplane Brake," Henry H. Kerr and F. C. Frank, *Journal of Aeronautical Sciences*, August, 1939, V 6, No. 10, pages 421-424.
2. "Passenger Car Brake Performance," T. P. Chase SAE *Transactions*, January, 1949, Vol. 3, No. 1, pages 27-39.
3. "Fundamentals of Heat Transmission Applied to Automotive Brakes," A. S. Van Halteren *SAE Journal*, July, 1938, pages 269-271.
4. "Heavy Duty Brakes—What's New," Ralph K. Super, SAE Preprint No. 225, August, 1948.
5. "Trend in Heavy Duty Brakes," Chester S. Ricker, SAE Preprint No. 332, March, 1949. Aviation brake drum—6-in. face—25-in. bore.
6. "Brake Drum Metallurgy," F. L. Main *SAE Journal*, August, 1932, pages 330-338.
7. "Metallurgical Aspects of Brake Drums for Heavy Duty Service," V. A. Crosby and G. A. Timmons, THE FOUNDRY, July, 1940, page 32.

Charleston Foundry Co., 1126 Main St., Charleston 21, W. Va., was destroyed by fire May 24.

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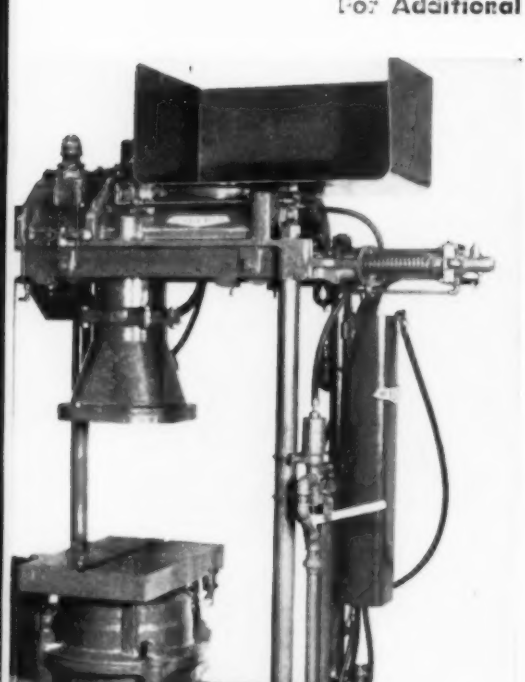
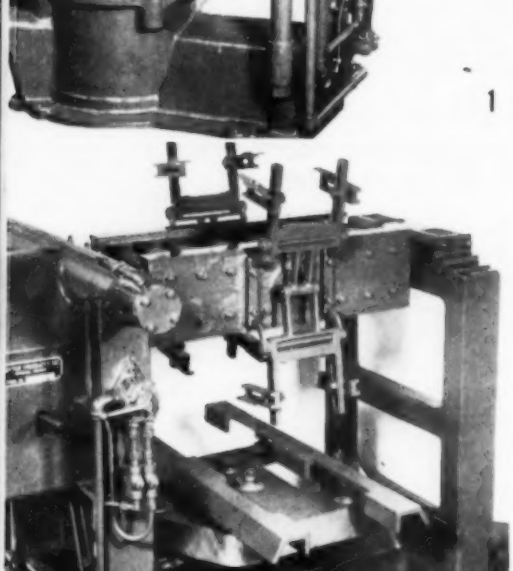


1

(1)—Automatic Controls:

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14 — Automatic controls have been developed by the company for many different types of foundry machines. A core blower equipped with these controls is shown here. The operating cycle of clamping the corebox, blowing the core, drawing the core, and refilling the sand reservoir is performed automatically with one manual control valve. The cycle is terminated automatically after each core is blown. This control can be used on the company's diaphragm or draw type core blowers. For the diaphragm type machines the average cycle is about 4 seconds and the blowing can be adjusted. On the draw machines the cycle varies from 8 to 12 seconds, depending upon length of draw required. Blowing time and vertical clamping pressures are adjustable to suit job conditions. The automatic control unit is pneumatically operated and requires no electric or oil timers.

For More Details Circle No. 1—Page 191

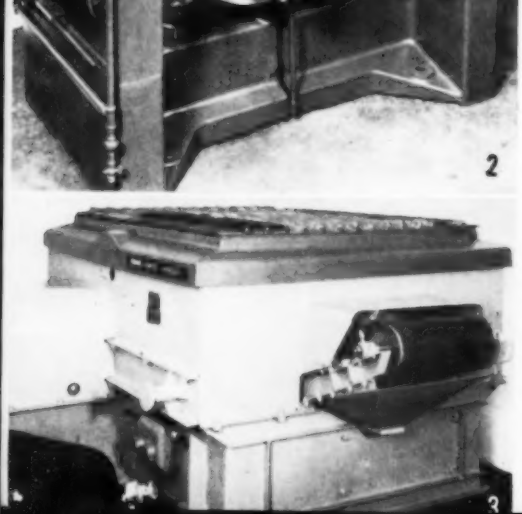


2

(2) — Core Drawing Machine:

Sutter Products Co., 2005 Westwood Ave., Dearborn, Mich.—Core drawing machine is designed for use with a core blower. Machine is equipped with two coreboxes. When one box is brought from the core blower the dryer is installed and the machine clamps it against the corebox. The box and machine frame then are rolled over by power. When the corebox has moved into the draw position, the table is raised automatically to unclamp, vibrate and draw. The operator rolls the empty corebox to the blower for refill and removes the core from the machine table. The machine is constructed of iron and steel castings with hardened and ground wearing surfaces designed to provide long life with minimum maintenance. It will handle many sizes of coreboxes, and it is said that boxes can be changed quickly.

For More Details Circle No. 2—Page 191



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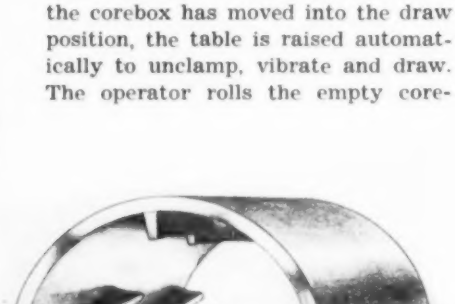


4

(3) — Combination Shakeout:

Robins Conveyors Division, Hewitt-Robins Inc., 370 Lexington Ave., New York 17 — Combination unit incorporates a shakeout, sand screen, lump breaker, feeder belt conveyor and tramp metal trap. The loaded flask is placed on the deck of the shakeout, which incorporates the company's full floating principle, providing for minimum transmission of vibration to the foundry floor. Castings, gaggers, risers, etc., are removed from the deck by hand. Sand passes through an integral hopper and falls onto a screening deck equipped with nonblind cloth. Screening deck is actuated by the shakeout vibrator, requiring no extra motor or other equipment. Loose sand falls through the nonblind cloth. Lumps pass under a self-activating lump breaker where they are crushed to screening size. Any sand supporters not remaining on the shakeout deck, nor small enough to pass through the sand screening surface, automatically travel to a discharge chute. Sand passing through the screening deck falls onto a Fiberglas belt capable of withstanding heat as high as 350°F and the abrasive action of silica sands. Conveyor is equipped with a permanently magnetized head pulley which removes tramp iron to a tote box or other receptacle. The sand is delivered to a conditioner or any other desired place.

For More Details Circle No. 3—Page 191

(4) — Cupola Tuyeres:

Sprow Tuyere Co., P. O. Box 109, Jackson, O.—Double auger tuyeres have internal ribs which cause a boring action of the blast. This is said to permit penetration of the blast air

farther into the stock than would be possible otherwise. The blast penetrates through the coke and melting stock, causing the highest temperature in the center of the cupola, somewhat above the tuyeres, rather than around the circumference. The lining is said to suffer less destruction and the heat is available where it is needed—for melting iron. Since there is a high temperature just above the tuyeres, no slag bridge can form, it is claimed. This gives a uniform melting rate hour after hour through the heat and constant metal temperature.

For More Details Circle No. 4—Page 191

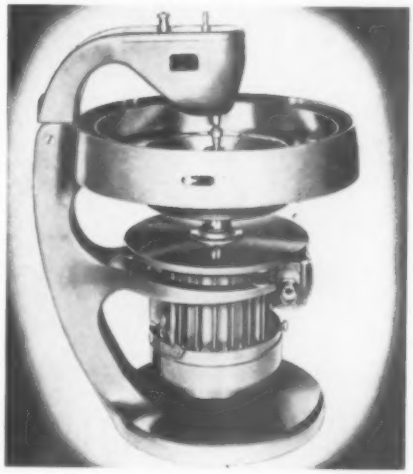
Hose: Carlyle Rubber Co., 64 Park Pl., New York 7—New all-purpose hose is said to be capable of handling air, water, gas, oil, grease, paint, insecticides, alkalies, oxygen, solvents, and many other liquids. Features claimed for the hose are that it has a specially compounded tube to resist many reactions of various elements, braided rayon carcass, minimum resistance to working pressures, oil and abrasive resistant long-lasting cover, light weight, and good flexibility.

For More Details Circle No. 5—Page 191

Air Rectifier: Hymatic Engineering Co., Redditch, Worcestershire, England—Air rectifier and reducing valve unit is designed to remove oil and water from high-pressure air and deliver dry, clean air. Rectifier can be installed in air lines or branches to serve a group of tools or pieces of equipment. Each rectifier can be used with up to three average size industrial spray guns and combinations of guns and tools using up to 25 cfm. The unit reduces the high pressure air on the inlet side to a constant value for delivery on the outlet side, irrespective of the rate of demand or pressure variation of the incoming air. Or the unit will supply clean air at no reduction in the high pressure supply. A flush-mounted pressure gage records the pressure of the outgoing clean, dry air. Unit is offered in four models, two suitable for pressures up to 120 psi and two for pressures up to 200 psi.

For More Details Circle No. 6—Page 191

Particle Classifier: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—Company has been licensed by Enkoping Verdstader of Sweden to manufacture, market and service the micro particle classifier illustrated. It is a precision laboratory unit for determining the fineness of materials ranging from 0 to 100 microns. A sample of fine material may be divided into eight or more particle size separations by passing it through the classifier. Each particle size separation is caught in a smooth metallic container for weighing and testing. The classifier may be used to determine the fineness of smoke particles, industrial dust, and many other finely ground materials. The unit is an air centrifuge and particles are separated by air velocities.



For More Details Circle No. 7—Page 191

Pattern Coating: Combined Supply & Equipment Co., 215 Chandler St., Buffalo 7 — Liquid plastic may be brushed or sprayed on wood or metal patterns and coreboxes to form a plastic coating that is said to prevent sand from sticking to the pattern. It may be used as a top coat over shellac or in place of shellac on new patterns and coreboxes. It also may be used under and over wax or leather fillets. It may be colored with regular pigment such as lampblack and vermillion, and if too thick, can be thinned with alcohol. The coating dries hard in approximately 1 hr at 70 to 80° F and the dried surface is said to be unaffected by water, alcohol, oils, or other common solvents. The coating resists abrasive action of sand. Material is supplied in quart, gallon, and 5-gallon bottles.

For More Details Circle No. 8—Page 191

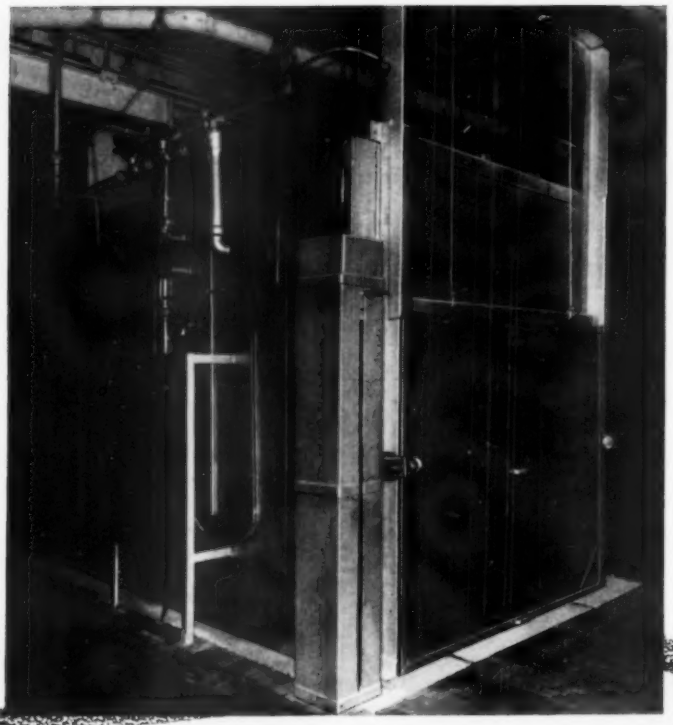
Sand Washer: Eagle Iron Works, 129 Holcomb Ave., Des Moines, Iowa—Screw type washer is used to separate extraneous matter from core sand from a water-sand blast cleaning system. Baked cores often break out of the castings in lumps and the action of the screw disintegrates them, delivering clean, dewatered core sand to a bin for storage and subsequent rinse.

For More Details Circle No. 9—Page 191

Hand Cleaner: Amaza Laboratories, Box 4114, Cleveland 23—Antiseptic, cream hand cleaner is designed to remove industrial soil with or without water. The compound contains scientifically formulated chemicals, including special antiseptics and lanolin. It contains no ammonia, alkaline salts or abrasives. It is said to discourage dermatitis, to soothe and aid chapped hands, cuts, and scratches. A plunger type wall dispenser discharges metered amounts of the semipaste cleaner into the palm of the hand. The compound is said to remove dirt, grime, grease, paint, varnish, shellac, printing and duplicating inks, hectograph and carbon stains, roofing and caulking compounds, soldering flux, putty, tar, carbon black, and other forms of industrial soil.

For More Details Circle No. 10—Page 191

Paving Bricks: Ironton Fire Brick Co., Ironton, O.—Specially developed non-spalling paving bricks, 3 x 4½ x 9 in., can be laid either on edge for a 4½ in., wearing surface, or flat for a 3-in.-thick pavement. Claim is offered that they are hard, dense and highly resistant to abrasion and heat shock. In a typical instance a floor was still in excellent condition after 11-years' constant operation. The bricks have been used extensively under and around



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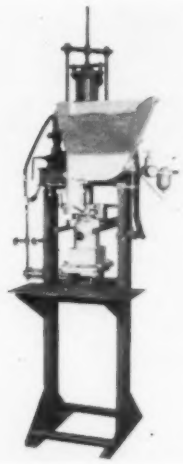
cupolas, also in gangways where hot metal and slag are splashed on the floor. For the past 15 years the bricks have been used in malleable iron foundries, around the furnaces, on the gangways and on annealing oven floors.

For More Details Circle No. 11—Page 191

Core Blower: Western Hardware & Specialty Mfg. Co., 3830 North Fratney St., Milwaukee 12—Core blower has been developed for blowing cores from the smallest to 6 lb. A feature of the machine is that core sand in the overhead hopper is conveyed mechanically into a fill tube ready for delivery into the magazine, all of this occurring automatically with each blow. The magazine, on tracks, is drawn back to filling position, opening a door at the bottom of this tube, and the sand is discharged into it. The main operating table is fixed, but variations in height of coreboxes are accommodated by a long stroke of the vertical clamping cylinder, which will accommodate coreboxes from 2 to 8 in. high. The machine can be furnished with an air chuck for quick handling of split boxes or simply equipped with a mechanical clamp. All clamping operations precede the blow, assuring positive clamping while blowing. The entire operation is controlled by an operating lever.



For More Details Circle No. 12—Page 191

Fluid Cylinders: Ledeen Mfg. Co., 1600 South San Pedro St., Los Angeles 15—New line of air and hydraulic cylinders has been developed for medium duty use in all industries wherever straight line motion is used. They are applicable for remote control operation, material handling, clamping or holding, and other uses. Cylinders utilize tie rod construction to give positive protection against leakage at joint of tube and head. Chevron packing

(*Continued on page* 194)

HELPFUL LITERATURE

50. Aluminum Casting Alloys

American Smelting & Refining Co., Federated Metals Div.—40-page illustrated technical treatise "Aluminum Casting Alloys" discusses metallurgy of aluminum alloys; corrosion; specifications of sand, permanent mold and die casting alloys; and various phases of aluminum foundry practice.

51. Molders Tools

Monk Tool Co.—8-page illustrated catalog No. 50 lists various types of molders tools including trowels of many designs, short heel tools, special lifters, hub tools, corner slicks, sprue cutters and miscellaneous related accessories.

52. Silica Sand

Ottawa Silica Co.—24-page illustrated booklet "Fifty Years with the Silica Sands of Ottawa" traces founding, development and present facilities of company for supplying flint shot, blast sand, flint silica, glassmaking sand, powdered silica, filtration sand and molding sand.

53. Materials Handling

Palmer-Shile Co. — 36-page illustrated catalog lists various materials handling equipment including trucks, skid platforms, pallets, racks, work tables, box and barrel grabs, carts and storage bins.

54. Air Guns & Fittings

Air-Way Pump & Equipment Co.—4-page illustrated form No. 641 depicts applications and lists features of Air-O-Chek leakproof air gun for blowing chips, dust and dirt. Air valves, hose assemblies, spray guns, extension tips and variety of fittings are covered.

55. Sand Recovery & Handling

National Engineering Co.—Two illustrated 4-page bulletins Nos. 504 and 492 describe National sand decarbonizer sand recovery system and Simpson Porto-Muller, a portable mixer for all types of foundry sand.

56. Foundry Engineering

Lester B. Knight & Associates Inc. —8-page illustrated booklet deals with professional foundry engineering as employed by group of consulting engineers in developing modern foundry methods and facilities.

57. Grinding Wheel

Norton Co. — 6-page illustrated folder entitled "First It Cuts. . . Then It Smooths" describes reinforced hub grinding wheel that permits rough and finish grinding with same wheel.

58. Melting Furnaces

Stroman Furnace & Engineering Co.—Illustrated bulletins Nos. 85, 90, 115 and 635 are descriptive of mechanical and hydraulic tilt, stationary crucible, iron pot and reverberatory melting furnaces, respectively. Bulletin No. 135 describes oil burners designed for use with furnace types listed above.

59. Cranes

Orton Crane & Shovel Co.—16, 16 and 8-page illustrated catalogs Nos. 76, 77 and 78 describe various models of air-controlled steam locomotive, diesel or gasoline locomotive and utility rail cranes, respectively.

60. Roller Conveyors

Standard Conveyor Co.—12-page illustrated bulletin No. 67 depicts gravity and power operated roller conveyors handling flat sheet steel; moving coils of steel and transporting materials in brass mills, airplane parts plants, foundries and other plants. Pneumatic tube service is discussed and illustrated also.

61. Ventilation Equipment

Claude B. Schneible Co.—Two illustrated bulletins deal with foundry ventilation. Booklet No. 450 describes functions, advantages and application of each hood in complete line of Uni-flo hoods for foundry shakeouts of all sizes, pouring stations and mold conveyors. Bulletin No. 550 explains plan for achieving foundry efficiency and economy through balance of all foundry air.

62. Flasks & Jackets

Diamond Clamp & Flask Co.—Illustrated price lists Nos. 650, 46F, 750, 546 and 647 contain prices of magnesium and aluminum flasks; Master flasks; cast-iron and aluminum jackets; steel slip jackets and bands; and steel core plates and flask bottom plates, respectively.

ADDITIONAL INFORMATION?

For additional information on any of the items described under "New Equipment and Supplies", "Trade Publications" or "Helpful Literature" in this issue — simply circle their corresponding item numbers on one of these cards.

FIRST CLASS
PERMIT No. 36
(Sec. 34.9 P.L.&R.)
Cleveland, Ohio

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THE FOUNDRY
Penton Building
Cleveland 13, Ohio

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18	38	58	78	98	118
19	39	59	79	99	119
20	40	60	80	100	120

THE FOUNDRY **7-50**
Penton Building, Cleveland 13, Ohio

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63. Lifting Magnets

Dings Magnetic Separator Co.—8-page illustrated catalog No. 220 lists capacities, dimensions and ratings of line of lifting magnets. Typical applications are shown.

64. Aluminum Pressure Casting

Accurate Match Plate Co.—16-page brochure "Aluminum Pressure Cast Pattern Equipment" discusses aluminum pressure casting processes and describes match plates, core boxes, cope and drag plates and aluminum and white metal castings.

65. Power Transmission Unit

Fafnir Bearing Co.—6-page illustrated publication form No. 406 explains Flangette ball-bearing power transmission unit consisting of pressed steel flange mountings and wide inner ring ball bearing with self-locking collar. Units are easy to install and are recommended for slow-speed light-duty applications to give advantages of antifriction bearings at low cost.

66. Blast Cleaning Equipment

Pangborn Corp. — 24-page illustrated bulletin No. 1200 describes complete line of equipment for the blast cleaning industry. Equipment includes Rotoblast airless blast cleaning machines, dust control units, air blast units, blast cleaning materials and accessories, and hydraulic equipment for cleaning castings.

67. Wet Sand Reclamation

Hydro-Blast — 8-page illustrated bulletin "Wet Sand Reclamation" explains method for recovering waste foundry sand. Reclaimed sand is said to be better in many respects to parent new sand for foundry molding purposes. Details of Hydro-Blast sand reclamation system are shown in large sketch.

68. Diecasting Machines

Kux Machine Co.—20-page illustrated brochure presents various sizes and models of high pressure diecasting machines, depicts design features and lists specifications of plunger gooseneck and cold chamber types for handling zinc, lead, tin, aluminum, brass and magnesium.

69. Large Fans

Clarage Fan Co. — 4-page illustrated bulletin 101 discusses use of vortex control type fans which afford efficient capacity regulation at constant speed. Adjustable and fixed vortex models are available in wide range of sizes and types for induced draft and ventilating purposes.

70. Casting Porosity

Tincher Products Co.—8-page illustrated folder "How to Recover Rejects Right on the Production Line" tells how Tincher process and equipment can be used to recover porous castings by sealing metal with special compound under pressure.

71. Mold Facing

Hercules Powder Co.—4-page leaflet Hercules NVX contains information on NVX water-miscible neutral resin for use in green sand facing. Material helps assure sand of good flowability, reduction of number of jolts and uniform ramming.

72. Portable Air Tools

Buckeye Tools Corp.—44-page illustrated air tool catalog contains data and specifications covering 147 different types and models of portable air tools. Included are medium-duty and light-duty disk and belt sanders, heavy-duty drills and reamers and new series of screwdrivers and nutrunners.

73. Gas-Electric Power Plant

Ready Power Co. — 8-page illustrated bulletin No. 99 depicts numerous applications of compact gas engine generator sets that produce power to operate electric industrial trucks, tractors, cranes and industrial locomotives.

74. Welding Accessories

Flood Safety Products Co.—6-page bulletin No. 6 and enclosed leaflets depict and describe welding accessories and industrial safety equipment. Such products as welders' helmets, leather clothing, magnifiers, Pro-Clamp positioners and nonpitting plastic cover lens are covered.

75. Hydraulic Lift Trucks

Barrett-Cravens Co. — 8-page illustrated bulletin No.5031 lists features of MD hydraulic lift truck having load capacity of 5000 lb with 6-in. lift and MX pallet model having 4000 lb capacity with 4-in. lift.

76. Steel Wire Pallets

Union Steel Products Co., Materials Handling Div.—4-page illustrated form RPI-9-49 depicts uses of lightweight steel wire pallets and Palletainers with folding sides and ends which open easily and fasten securely to form rigid steel mesh container.

77. Power Wheelbarrow

Kwik-Mix Co.—4-page illustrated form KM 280-1 announces improvements in Moto-Bug power wheelbarrow with 10-cu ft hopper body, 1200-lb platform body and hydraulic fork lift attachment with 500-lb capacity.

78. Air Velocity Meter

Illinois Testing Laboratories, Inc. —8-page illustrated bulletin No. 2448-G describes Alnor Velometer. This instantaneous direct-reading air velocity meter checks air speeds up to 24,000 fpm and pressures to 20 in. of water.

79. Sand Handling

Newaygo Engineering Co.—6-page illustrated bulletin No. 205 depicts how more molds can be made with fewer motions with Handy Sandy sand handling machine designed for use in molding floors and core rooms, and for batching or loading sand.

1	21	41	61	81	101
2	22	42	62	82	102
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THE FOUNDRY 7-50

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THE FOUNDRY

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Readers' Service Dept. Cleveland 13, Ohio

HANDY SANDY proves it's cost-cutting performance

at the foundry show

Foundrymen attending the Cleveland Show were amazed to see how many more molds a molder can produce when he has no hand shoveling to do. With the Handy Sandy, he just reaches overhead and pulls the gate lever or actuates a conveniently located air valve if gate is air operated. As there is no bending or stooping, he works as hard in the afternoon as he does in the morning and maintains the same high-speed production all through the day.

in foundries everywhere

Users report production increases of 30% to 70% through use of the Handy Sandy. This individual-floor sand unit pays for itself by reducing your cost per mold. It takes the shovel out of the molder's hand and lets him devote full time to molding.

If you haven't seen a Handy Sandy in operation, you owe it to yourself to write for the name of a user in your vicinity. Write too, for your copy of the new Handy Sandy bulletin "Fewer Motions — More Molds." There's no obligation of course.

INCREASES MOLDER'S OUTPUT 50 MOLDS PER DAY

at the Michigan Wheel Co.
Grand Rapids, Michigan

This company replaced hand shoveling with a Handy Sandy in casting 4 pound propellers from Manganese Bronze. One Molder, shoveling, produced 50 to 55 molds per day. NOW, with a Handy Sandy, the same man turns out 90 to 100 molds daily — and still "feels like working another shift."

A BONUS OF 122 MOLDS PER DAY

at Industrial Castings Co.
Detroit, Michigan

Installation of a Twin Hopper Handy Sandy nearly doubled the output of two molders at Industrial Castings Co. Their daily production jumped from 140 to 262 molds. They expect to turn out well over 300 molds when the carry out distance is reduced.

30% MORE PRODUCTION

at the Cast-Rite Foundry Co.
Decatur, Illinois

"We are well pleased with the results obtained from the 'Handy Sandy.' This unit has increased production by 30% on work in our shop and has consequently lowered our cost of operation. We find the cost of installation on this type unit negligible in comparison to a complete overhead sand system

Write today for the new bulletin "Fewer Motions —More Molds."

Manufacturers of NeWay Mold Handling, Sand Handling and Conditioning Equipment

NEWAYGO ENGINEERING COMPANY | Newaygo, Michigan

(*Continued from page* 190)

is used to seal piston rod. Synthetic cups and automatic cushion are standard construction. Various head and rod attachments provide for almost universal mounting requirements.

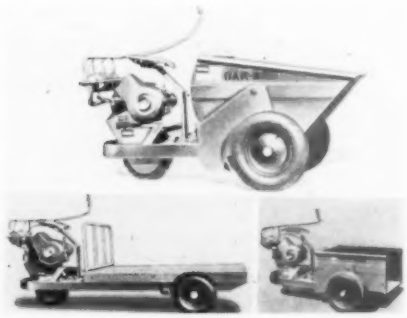
For More Details Circle No. 13—Page 191

Surface Hardness Testing: Peabody Industries Inc., 1863 Penobscot Bldg., Detroit 26—Pocket-size surface hardness testing instrument

is designed for use by any shop employee. In operation, the instrument is placed on the surface to be checked, a hammer is released, and accurate readings within commercial hardness limits are available in less than a second, it is claimed. It gives readings on any of the three standard scales—brinell, Rockwell B and Rockwell C. The instrument is said not to mar surface of work being tested.

For More Details Circle No. 14—Page 191

Power Cart: Gar-Bro Mfg. Co., 2416 East Sixteenth St., Los Angeles—Three interchangeable trays are featured in the improved power cart which has a load capacity of 2000 lb or 14 cu ft of bulk material. The unit is designed to travel at speeds up to 10 mph and to climb 20 per cent grades with full load. The newly designed bulk handling tray is balanced on trunnions at each side. It



dumps or pours under the complete control of the operator. Bulk tray, box, or platform tray can be interchanged in less than 5 minutes, it is claimed. Steering and power control are by tiller. This tiller when held in a downward position engages the 7 hp, 4-cycle engine to go forward, or held in an upward position to reverse. Releasing the tiller automatically disengages the power. Speed

(*Continued on page* 196)

This seal stands for . . .

DEPENDABLE SERVICE to the Foundry Industry

Back of the Hickman, Williams' Symbol of Service stands an organization whose entire facilities have been devoted to the foundry industry for Sixty Years.

Our 9 service offices comprising the Hickman, Williams' "network", are staffed by foundry specialists who are prepared to help you secure those commodities that may be in short supply.

For fast, experienced action, call the office nearest you.

60th Anniversary
1890-1950

Hickman, Williams & Co.
(INCORPORATED)
CHICAGO · DETROIT · CINCINNATI · ST. LOUIS · NEW YORK
CLEVELAND · PHILADELPHIA · PITTSBURGH · INDIANAPOLIS

Introducing the NEW STROMAN MODEL "R" FURNACE

For Grey Iron Melting or Duplexing

Front view of 6000 lb. furnace

Here is the furnace that the grey iron foundrymen have been waiting for. The Stroman Model "R" has many uses. It can be used as a receiving ladle in front of the tapping spout of a cupola, or it can be used as a separate unit and metal poured into it from transfer ladles. Temperatures then can be increased and at the same time additions can be made. Carbon can be held constant or increased or decreased as desired. It may also be used for cold charging, and bringing the metal to casting temperature. No matter which way it is used it is the most economical and efficient furnace available for this type of work.

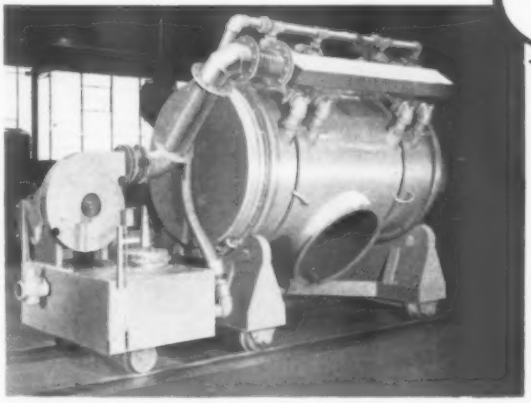
Castings made from the Stroman Model "R" Furnace show an excellent grain structure, free from porosity, pressure-tight, good machineable iron.

The heating system of this furnace is of a revolutionary design. The burners fire tangentially to the furnace lining. The flame travels along the roof, down the side wall in front of the furnace, over the metal, and back up under the burner. This manner of flame travel accounts for the extremely high temperatures attainable in this furnace.

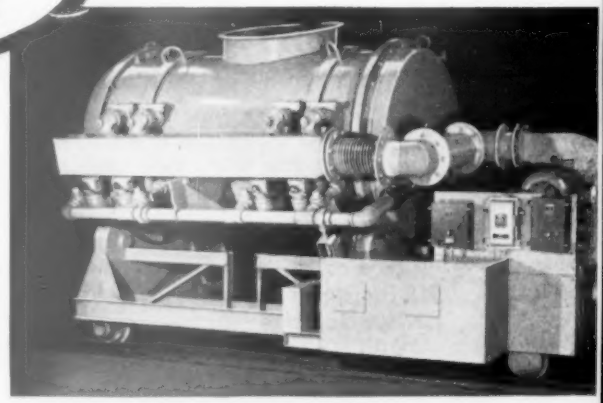
Fired by gas, oil or combination gas-oil, fuel costs are exceptionally low. The Model "R" furnace is made in both stationary and mobile types, according to the purpose for which they are used. Capacities range from 2,000 to 10,000 pounds. This furnace will solve many problems in the production of your castings. Keep up with the most modern developments in metal melting . . . write Stroman today for full information on their complete line of ferrous and non-ferrous melting furnaces.

ATTENTION NON-FERROUS FOUNDRIES

This Stroman Model "R" Furnace is also ideal for melting brass or bronze for large castings . . . as a reclamation furnace in large foundries, or for smelting or refining of copper base alloys.



Furnace in tilted position



Rear view showing heating system

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

CRESCENT CHAPLETS

FUSETITE

If you don't see it here .... ask for it!

We manufacture a complete line of all types and sizes of Foundry Chaplets, and all kinds of wire and metal formations for your foundry use. If we don't already make what YOU need, we'll design and develop just the CHAPLET to suit your requirements. Your inquiries and specifications are invited - - - - for quick service, write for working samples. As a few of our specialties:

- RADIATOR CHAPLETS
- SHOULDER CHAPLETS
- BOILER CHAPLETS
- DOUBLE HEAD CHAPLETS
- MOTOR CHAPLETS
  (Regular or Extended stems)
- TIN TUBES
  (Plain or Perforated)
- FOUNDRY NAILS
  (Plain, Nicked or Barbed)
- SKIM GATES
- CORE WIRES
- CORE PLATES and SHIMS
- TAPER DRIVE PLUGS

CRESCENT FUSETITE CHAPLETS ARE MADE ACCURATE OF PROPER ANALYSIS MATERIALS FOR THE FUSING-IN PROCESS.

Being the Originators and Manufacturers of Radiator, Shoulder, Double Head and Motor Chaplets, Your Foundry benefits by our Chaplet Manufacturing experience since 1889 for the leading Stove, Radiator, Boiler and Motor Foundries.

We carry thousands of different types and sizes in stock for quick delivery, and have the facilities to make up special sizes promptly.

WRITE FOR SAMPLES AND PRICE LIST.

Crescent Brass & Pin Company

5766 TRUMBULL AVE.

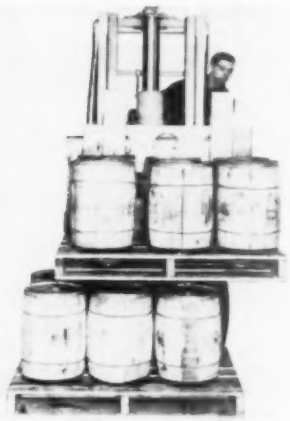
DETROIT 8, MICHIGAN

(*Continued from page* 194)

is controlled by a foot throttle. The single rear wheel permits 180 degree turns within a radius of 4 ft. Overall length is 85 in.; width 39½ in., and height 50 in. Weight is approximately 690 lb.

For More Details Circle No. 15—Page 191

Load Positioner: Yale & Towne Mfg. Co., Roosevelt Blvd. & Haldeman Ave., Pniladelphia 15 —



Hydraulically-operated side shifter attachment is designed for use with models of the company's fork trucks. The device shifts the forks as much as 4 in. to the right or left of center, making possible spotting of loads in odd corners, close to walls, near pillars, or in other confined transfer and storage area. Manual positioning in such enclosed spaces as trailer trucks and freight cars is reduced. The side shifter is easily removed from the trucks to permit installation of other accessories.

For More Details Circle No. 16—Page 191

Lifting Clamp: Merrill Brothers, 56-02 Arnold Ave., Maspeth P.O., New York—Lifting clamp has a movable gripping jaw that can be

set by hand to accommodate the part to be lifted. The clamp is said to lift any metal object up to 12 in. thick that its adjustable jaws can grip. If larger openings are required they may be supplied on special order.

Another feature claimed is the clamp's ability to lift from the horizontal to a vertical position without changing the grip, as shown in the accompanying illustration. Clamps are available in 1 or 3-ton capacities, each with a 5 to 1 safety factor and jaw opening of 0 to 12 in. The smaller model weighs 30 lb and the larger, 60 lb.

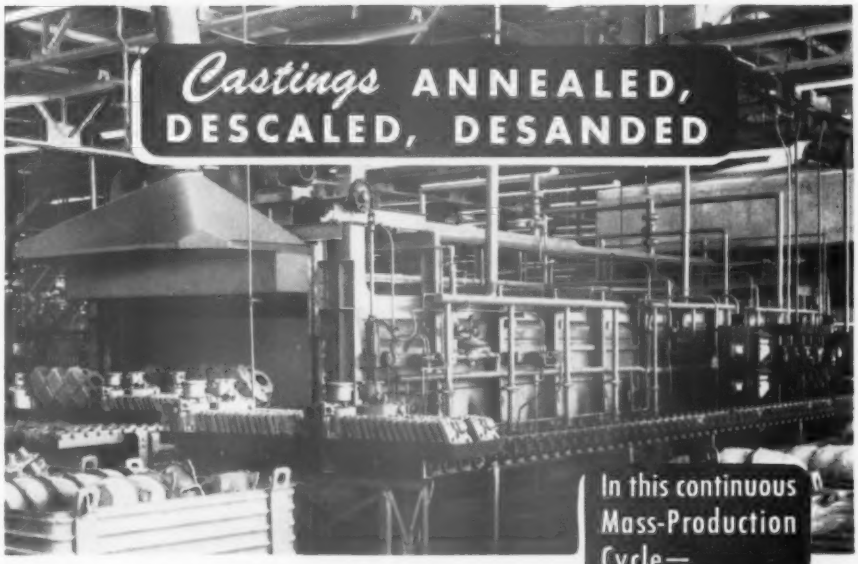
For More Details Circle No. 17—Page 191

Hand Torch: Pressure Products Corp., 140 North Dearborn St., Chicago 2—New hand torch is designed to light instantly, without pouring, pumping or priming of fuel and burns with a clean, blue flame of more than 2200°F. It utilizes a newly developed self-pressurizing, self-vaporizing liquid fuel compounded of petroleum hydrocarbons packaged in a seamless steel, disposable container about the size of an ordinary beer can. The pressure, self-developed at

normal temperature, is said to be constant enough to continue until the fuel can is emptied. The fuel is odorless and nontoxic. The fuel container is designed to be sealed easily into position as the fuel tank of the torch. Two interchangeable tips come with the torch. One throws a long, broad flame for work where a great deal of heat is required quickly. The other tip produces a long pinpoint flame suitable for soldering and other work where heat must be concentrated in a small area.

For More Details Circle No. 18—Page 191

Wet Water: Aquadyne Corp., 220 East 42nd St., New York 17—Water additive for controlling foundry dust is a concentrated, multiphase wetting compound used to reduce the interfacial tension of ordinary water and to increase wettability of all types of dust and powdered materials. A 3-lb capsule of the compound, when used in a specially designed blending unit, dissolves in 1000 gal of water. The compound is said to mix com-

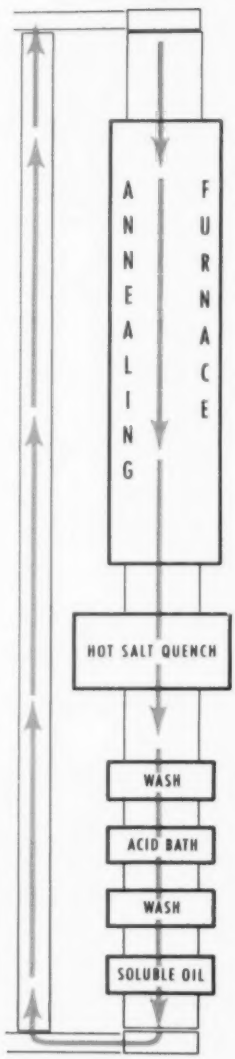


BLAZING THE HEAT-TREAT TRAIL

You'll save floor space, manpower, material handling when you tie this new Holcroft furnace into your production line. It combines annealing, descaling and desanding operations in *one* compact unit!

One furnace—now being used in an automotive plant—has a capacity of 10,000 pounds per hour. Trays of castings are conveyed through the furnace at temperatures up to 1250° F.—then down into a salt quench. The castings are then rinsed with water, bathed in acid, water-washed again, and dipped in a soluble oil to prevent rust. The cycle is repeated every 4½ minutes. Variations can be made when necessary.

For information on how this furnace can be adapted to *your* job, write us today.



SINCE 1916 Holcroft AND COMPANY

BUILT BY HOLCROFT & COMPANY DETROIT-MICH.

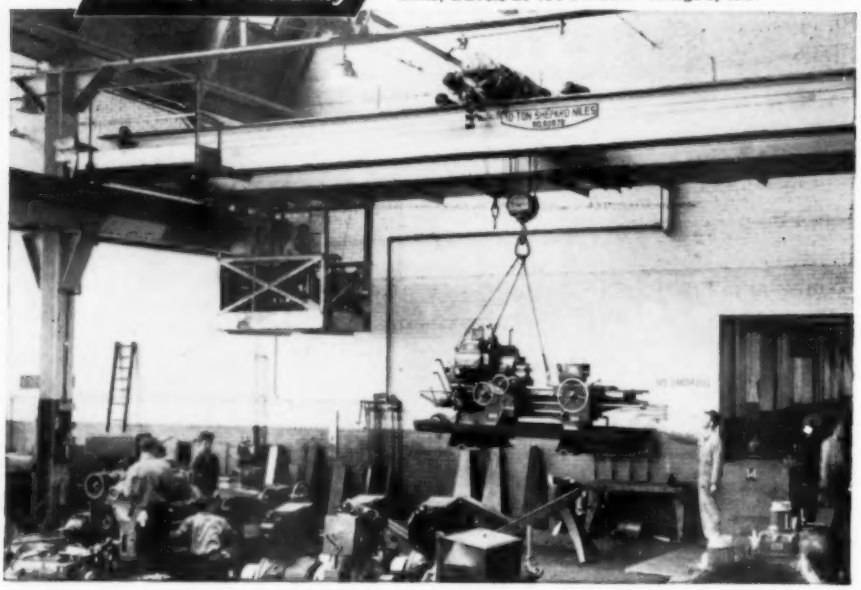
PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

6545 EPWORTH BLVD. DETROIT 10, MICHIGAN

CHICAGO 9 — C. H. Martin, A. A. Engelhardt, 4209 South Western Blvd.
CLEVELAND 2 — Wallace F. Schott, 6516 Detroit St.
HOUSTON 1 — R. E. McArdle, 5724 Navigation Blvd.
CANADA — Walker Metal Products, Ltd., Windsor, Ontario
EUROPE — S.O.F.I.M., Paris 8, France

For Lowest Cost Per Load-
Use Dependable
Thru-the-Air Handling

For this installation, operating conditions called for rapid travel over a large area. Controlled by operator in the cab, this Shepard Niles 10-ton, welded-beam crane, with main and auxiliary hoist units, travels at 450 F.P.M.—bridge speed.



we start by asking "what"

WHAT are *your* problems? Under WHAT conditions will *your* crane be operated—intermittently, or under fairly constant conditions? WHAT are the operating speeds necessary to meet *your* productive cycle?

Your answer to these and similar questions will enable us to engineer your installation so that it will give you the best, and longest service—at the lowest cost per load over the years.

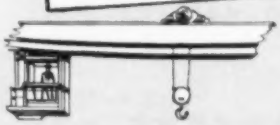
Be sure you get the crane best qualified to do *your* job. It's wise—and costs you nothing—to get the facts first, rather than to make expensive changes later.

May we place our experience of a great many years of successfully designing all types of crane installations at your disposal?

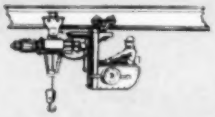
Shepard Niles

CRANE & HOIST CORPORATION

Makes and sells all three lifting tools for airborne shop loads



CRANES • Overhead



HOISTS • Cab Operated

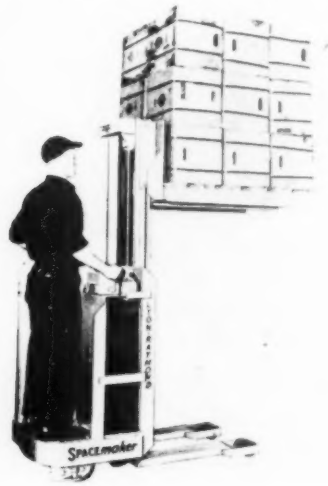
HOISTS • Floor Operated

360 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

pletely with water at any workable temperature without agitation or stirring. It also is said not to salt out at any dilution and is nontoxic, noninflammable, noncorrosive, odorless, and harmless to skin and clothing. Blending unit has a clear lucite cylinder, held between two brass heads, which holds two capsules of the wetting compound. Lower metal head contains the water inlet and outlet connections. The "wet water" solution, when used as a spray, is recommended for eliminating dust developed at all dust generating operations. In addition to facilitating control of dust, the "wet water" is said to penetrate and eliminate sand and clay balls and to aid the mixing and blending of sand binders with less moisture.

For More Details Circle No. 19—Page 191

Tiering Trucks: Lyon - Raymond Corp., 6566 Madison St., Greene, N. Y.—Electric tiering truck is de-



signed to tier from narrow aisles and in congested areas. In field tests the truck has tiered 48 x 48-in. pallet loads at right angles from a 6-ft aisle, and 24 x 36-in. box skids have been right angle tiered from a 5-ft aisle. The lightweight, maneuverable truck is furnished in three types: Platform type for tiering skids; fork type for tiering single face pallets, and straddle type for tiering two faced pallets.

For More Details Circle No. 20—Page 191

Oil Absorbent Material: Philip Carey Mfg. Co., Lockland, Cincinnati 15—Improved oil and grease absorbent material is said to have a higher quality asbestos fiber content and is classified as noncombustible by Underwriters' Laboratories Inc. It may be used to retard the spread of fire, it is claimed. It was developed to remove oil and grease wherever they accumulate and constitute an undesirable hazard or appearance.

For More Details Circle No. 21—Page 191

TIN BRONZE CASTINGS

(*Continued from page 79*)

Riser Compounds—Riser compounds may be considered to be of two types: Exothermic compounds, or those which depend upon a chemical reaction to produce sufficient heat to prevent the metal solidifying; and those having an insulating action and which will retard the loss of heat from the molten metal sufficiently to permit it to remain molten long enough to supply the necessary feeding.

In general, chemical riser compounds for bronze consist of a mixture of carbonaceous material and an oxidizing agent blended in suitable proportions to cause them to burn slowly at the interface between the riser surface and the powdered material. Once ignited by the heat of the molten metal, the layer of compound continues to burn slowly, producing sufficient heat to prevent the underlying metal from solidifying on the surface. There is hardly enough heat produced to do more than prevent the formation of the frozen surface skin, therefore the riser must be large enough to remain molten by itself as long as the feed demand continues.

Used in Riser Walls

An extension of these exothermic riser materials are those which may be molded into cylinders or other suitable shapes to form the walls of the riser. Several of these compounds are on the market. By using such a riser "sleeve" the heat which is evolved at the riser walls will prevent or retard solidification against the walls until the casting has solidified. By the use of such a liner, the diameter of the riser can usually be reduced considerably. The use of a riser sleeve does not eliminate the necessity for a riser compound on the surface to prevent the formation of a skin which would prevent access of the atmosphere to the surface of the molten metal.

Still another variation of exothermic compounds are those which, while providing heat to keep the riser in a molten state, also provide metal of the same composition as that in the casting. These are actual thermit mixtures which are placed in the riser, usually at the time when the metal has risen but a short distance into the riser cavity. The heat of the metal ignites the mixture which then reacts to produce metal of the required composition. The thermit reaction produces large quantities of heat plus a considerable volume of

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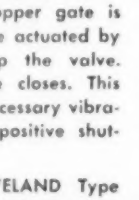

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hot insulating slag, both of which will insure that the riser remains open to the atmosphere without the use of additional insulators.

These thermit compounds have been developed and operate very successfully with steels and Monel metal which solidify at comparatively high temperatures. So far they have not been successful with bronzes, primarily because the temperature of these molten alloys is not high enough to initiate the reaction in any suitable thermit mixture which has been developed to date. A suitable mixture must ignite at temperatures below 2000° F, yet must not react in an explosive manner. We have not been successful in obtaining a suitable compromise between these two requirements.

Several Materials Available

In the case of simple temperature insulation, it is possible to obtain fairly good results by the use of powdered charcoal, infusorial earth, or plaster of paris added to the riser, preferably at the time that the metal enters the bottom of the riser cavity, at which time it is still at its highest possible temperature. Care must be taken to select those materials which will not harm the sand if they become incorporated in the heap or system, otherwise they must be removed completely before the mold is shaken out. Such a riser cover will only tend to prevent the surface of the metal from freezing over prematurely. It will not permit a reduction in the size of the riser.

Probably the most easily applied and yet very effective riser insulations which have been developed to date are the gypsum sleeve which was developed by the Naval Research Laboratory[5] and the plastic-infusorial earth sleeve developed at the Puget Sound Naval Shipyard[6]. By using such a riser sleeve, it has been possible to obtain soundness in bronze castings beyond that previously experienced, except by very special cooling processes. These sleeves are easily applied and the material from which they are made is low in price. All in all, they probably represent the most economical method yet developed to provide thorough feeding. Similar proprietary compounds for making riser sleeves are also on the market.

The gypsum sleeves have these certain disadvantages and limitations:

1. They are fragile and easily broken unless handled very carefully.
2. A section of the foundry or the coreroom must be set aside for their preparation and baking.
3. They are suitable only for nonferrous alloys poured below a temperature of about 2400° F.
4. They are not suitable for alloys containing considerable amounts of nickel.
5. Because of their fragility, they are likely to be easily powdered and will enter the sand system during the shakeout unless preventive measures are taken. Any gypsum in the sand might ruin it for further use, especially for molding Monel or other high-nickel alloys.

The plastic-bound sleeves consist of a mixture of bentonite, infusorial earth and a suitable plastic. The components are intimately mixed in a muller and molded to the required shape. They have some of the disadvantages displayed by the gypsum sleeves, especially as regards their preparation, but they are much less fragile and will stand up under ordinary foundry handling. They are suitable for ferrous alloys, Monel and metals poured at a high temperature. Furthermore, they contain no constituent which will react with the metal. It is also probable that they will not harm the sand if they become intermixed with it in the system.

It is probable that a hard-burned, porous ceramic sleeve would be as effective as the above-mentioned materials in providing the necessary insulation. Such a sleeve could be produced in quantity in standard sizes and shapes. It would only have to be removed from the shipping container and placed in the mold without any prior treatment by the foundry save perhaps a short drying and heating in a core oven. A ceramic sleeve would tend to break off the riser in large pieces which would be removed during the subsequent sand reclamation. Even if some of it became powdered, it would have little or no effect upon the sand.

Blind Risers—Theoretically, a blind riser, properly designed and applied, should feed a casting satisfactorily. Blind risers have been used for years with more or less success, chiefly to feed portions of castings which could not be reached by open risers or which were at the bottom of deep molds, making the use of open risers uneconomical. In many cases, these blind risers were found to be more trouble than they were worth, actually increasing the amount of shrinkage in the casting.

Fig. 9A will explain the reason for some of the earlier difficulties. On pouring, the metal fills the mold and the riser cavity completely, pouring being continued until metal rises in the vents. A chilled, impervious skin is formed wherever the metal comes in contact with the sand. This skin surrounds the casting and the riser, forming a completely closed system entirely isolated from the atmos-

phere. This being the case, the only feeding pressure comes from the head of molten metal, the liquid pressure tending to equalize between the mold cavity and the riser. After this, there is no reason why the molten metal should flow from the riser into the mold cavity, or in the opposite direction for that matter. As a result, we have no feeding, and shrinkage will occur in the casting, extending through the riser neck and into the riser.

Of course, if the metal in the riser is hotter than that in the mold cavity, there will be a slight tendency for the molten metal to be drawn into the casting but this tendency will be almost completely counteracted by the pull of the metal in the opposite direction. Even with a considerable temperature differential, the weight of the metal will have little opportunity to cause metal flow toward the casting. With such a riser system we are almost certain to have shrinkage in the casting. The difficulty will be aggravated if the gating used is such that the metal is conducted through the mold cavity into the riser. In this case, the riser, being colder, may freeze first and the tendency to draw metal from the casting will be increased.

Permits Ingress of Air

The shrinkage experienced with the ordinary blind riser can be prevented by the use of the Williams principle as illustrated in Fig. 9b. The only real difference between the original Williams riser and the ordinary blind riser is the use of a "fire-cracker" core inserted into the sand wall of the riser and extending a short distance inward. The fire-cracker is made of ordinary core sand and is usually vented for its entire length.

When using this riser, the mold cavity and the riser are completely filled as before, the gate and the vents freezing off. The same closed system is formed by the continuous chilled skin. Where the cylindrical core enters, however, this skin is necessarily thinner where it lies against the sharp edges of the core. In addition, the core is rapidly heated and the heat remains concentrated at this point because of the poor conductivity along the narrow core. The result is that a hot-spot is formed and the skin is considerably weaker than at any other point in the system, sufficiently weak that the vacuum formed by the liquid-to-solid shrinkage in the closed system actually breaks the skin and permits the ingress of air at this point, the atmospheric pressure forcing the molten metal through the riser neck and into the solidifying casting. This barometric

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action will continue until the casting has solidified completely, leaving a distinct shrinkage cavity in the riser as indicated in the illustration, or until the neck becomes frozen across if this neck is too small.

It is evident that the design of this riser must be such that the neck is sufficiently large, exactly as indicated for the side attached open riser illustrated in Fig. 7. Also the riser must be sufficiently large to provide the necessary feeding without the shrinkage cavity extending completely through the neck. Another requirement which should be self evident is that the riser must be the last to freeze, otherwise it will fail to work and the casting will feed the riser. The simplest answer to this is always to gate into the riser, never to fill the riser through the casting.

The riser illustrated shows the original Williams design. A little thought will show that a flat top would be better than the spherical top, the skin forming across a flat surface being considerably weaker than would be the case with the dome shaped top shown. A wedge core, as shown in Fig. 11A, placed across the top and extending into the metal, or a sharp pyramid or cone, would work equally as well as the fire-cracker core.

Skin Is Weak

The Williams riser, as originally designed, is not suitable for use with tin bronzes or with most other copper-base alloys, chiefly because of the weakness of the chilled skin when it is first formed. We must bear in mind that the feeding of the regular Williams riser is due to the barometric action produced by the atmospheric pressure forcing molten metal in to fill the vacuum formed by the solidifying metal in the casting. It works only because the skin formed around the casting is thicker and stronger than that around the core in the riser. As soon as the continuous skin is formed and before the atmosphere enters, there is an actual pressure on the outside of the casting located higher than the top of the riser, tending to force the walls inward. Bronze freezes with a very weak skin, and the walls will actually be forced inward as indicated in Fig. 10A. The vacuum due to the solidification will then be counteracted and may be insufficient to cause the skin to break around the fire-cracker core. The skin may then have the opportunity to build up around the core until it becomes thick and strong enough to resist breaking through, and hence no feeding will result.

In order to be suitable for bronze, the blind riser must be sufficiently high that the top of the molten metal inside it will always be higher than that in the casting and will be in liquid contact therewith until the casting is frozen, as illustrated in Fig. 10B. The greater ferrostatic pressure will then be in the riser and will prevent drawing in of the casting walls.

Fig. 11 illustrates several types of blind risers used successfully with bronzes. The wedge core has already been explained. In Fig. 11B, no core is used, but a large vent is carried through to the top of the mold. This must be large enough to prevent its freezing off for some time after it and the riser have been filled. Another requirement is that the mold edges at the junction of the vent with the riser be sharp and not rounded off as is usually done. The sharp edge is heated by the metal flowing past it into the vent, with the result that the chilled skin at this point is very thin compared with that elsewhere in the mold system. As the casting freezes, metal will be drawn from the riser, also from the vent until the latter freezes over, then the vacuum (or the external air pressure) will break the thin wall and permit atmospheric air to enter.

In Fig. 11C, feeding depends upon the weakness of the riser walls, permitting them to break and permit ingress of the air to promote feeding. Feeding will be somewhat improved, or at least will be initiated and continued with greater assurance, by providing the riser with flat sides and top as shown. Flat surfaces will draw in and break much more easily than will concave surfaces.

As the successful feeding of a blind riser depends entirely upon atmospheric air entering the riser cavity through a fractured wall, it will be evident that permeability of the sand should be as high as practicable. Further, care must be taken that the walls of the cavity or the core are not made impermeable by the use of mold washes. The interior of a blind riser should never receive any kind of a wash.

Venting—The only purpose of a vent is to provide an opening in the mold to permit the outflow of air and mold gases from the mold cavity ahead of the incoming molten metal. They do not provide feeding. Any vent will cause a small but distinct hot spot where it joins the casting, with the result that a tiny shrinkage cavity is usually found at the base of the vent when it is removed from the casting. The smaller the vent, the smaller will be the shrinkage cavity. A $\frac{3}{16}$-in. vent wire is commonly used for making the vents, but a flat strip $\frac{1}{8}$-in. thick by slightly less than $\frac{1}{2}$-in. wide will provide exactly the same venting area, with

only one-third the opportunity to form a shrink cavity.

Flat vents are, therefore, better than round ones having the same area. This is even more true with blind risers where the feeding of the casting depends upon a closed system being formed, making it highly desirable that the vents freeze off as soon as possible after being filled. If a large, round vent is used to carry off gases from the mold cavity, it may provide a hot spot of sufficient size to start feeding through at the base of the vent rather than through the riser wall, in which case a shrinkage cavity would form in the casting.

Padding—In the preceding discussion concerning solidification in various section shapes, it was explained why tapered sections should be used wherever possible. It is true that few of the castings we are called upon to make are shaped like a wedge, and it may become necessary to simulate this shape in many uniform wall sections, where tapered sections are necessary to obtain soundness. In many cases it will be possible to alter the design to provide the necessary taper. In other cases it will be necessary to build the pattern to provide this taper which will be removed after the casting is completed. Such extra metal added to provide directional solidification is usually known as padding, but is sometimes known as "swells," especially when added in isolated spots on the casting. The padding must be surmounted by suitable risers to provide final feeding.

Padding must usually be removed, either by the foundry or by the buyer. Special care, therefore, should be taken in deciding upon its location, so that it will provide the necessary feeding yet can be removed in the most economical manner. Often it can be located so that it will be removed by regular machining operations, without too much extra work or expense. In other cases it will have to be removed by chipping, grinding or other suitable means. Another difficulty may be introduced in addition to the trouble in removing the padding. Any extra thickness in a wall section will slow up the freezing rate and cause larger grain size. This may increase the tendency to low physical properties. Padding should be sufficient to provide the necessary feeding but should not be excessive.

(To be concluded next month)

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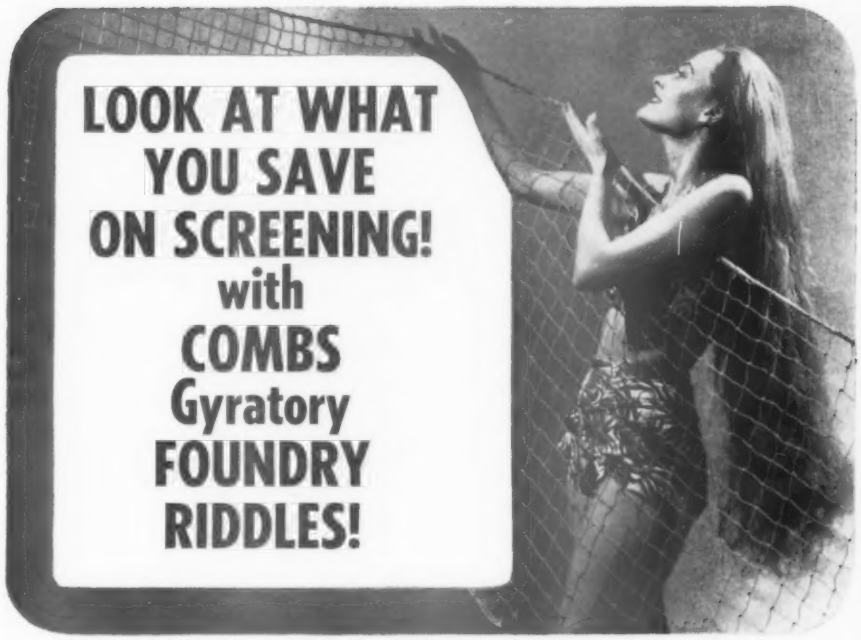

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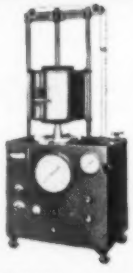

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Gating

(*Continued from page 74*)

be considered enlagements) show, as in finger gates, that use of enlargements decreases momentum of the incoming metal but not sufficiently to produce the desired sequence flow in all cases.

Common Junction Steps—Fig. 9 shows use of novel system of slanting two or more of the steps upward from a common junction at the sprue. Figs. 9A, 9B and 9C show gate systems with all three steps radiating from a common junction. In the first two, limited sequence flow was obtained through only the lower two steps. In the third (Fig. 9C) for which the angle of inclination of the lower step was 60 degrees, metal ran back into the top step at first, but later an indication of weak flow from this step was apparent.

In attempts to improve the flow from the top step, the second group of gating systems (Figs. 9D through 9F) had only the two lower steps joined at a common junction. The top step was divorced because it was believed that the flow distance in the top step from the multiple junction to the point of entry at the casting was too great to permit the desired flow. With the top step set horizontally (Fig. 9D) feeding was slightly better through this step than in the systems of 9A to 9C, but it was still very weak.

Inclining the top step 30 degrees (Fig. 9E) did not produce better results. A beneficial effect on the flow, however, was produced by inclining the top step 60 degrees, as in Fig. 9F. The lower steps feed in order, and although at first metal ran back into the top step, strong surface turbulence later indicated that this step was functioning properly.

Figs. 9G through 9I show a change in the location of the junction point so that only the upper two steps are connected. The bottom step was retained steeply inclined upward at 60 degrees for comparison with Fig. 9C. In the first system (Fig. 9G) with the middle step parallel to the bottom step, strong initial flow occurred at the bottom step and sequential flow was obtained from the middle step, but metal ran back into the top step.

Changing the angle of the middle step to 45 and to 30 degrees (Figs. 9H and 9I, respectively) progressively improved the flow from the top steps. Although metal ran into the top steps at first, flow soon occurred from these in sequence; flow from the bottom steps was still strong. To decrease the jet effect of the flow from the bottom step the step was inclined only 45 degrees (Fig. 9J). Sequence flow with reduced force from the bottom step resulted.

The systems in Fig. 9 show that (1) with proper design the desired sequence flow occurred from all three steps; (2) the bottom step must be inclined so that after the first flow occurs preference for the continuance of flow through this step is decreased; and (3) the most satisfactory sequence flow from the upper two steps is obtained which these steps radiate from a common junction.

Reversed Sprues—Functioning of step gating systems with reversed sprues is shown in Fig. 10 using the common "saxophone" or "trombone" type of gate. In the first system flow was obtained from all three steps, but dribbling and premature flow occurred from the middle step. To reduce the momentum of the metal stream, believed the basic cause of such premature feeding, enlarged sections (Figs. 10B and 10C) replaced the bend in the sprue.

In the system of Fig. 10B the bottom step fed quietly and the top step correctly, but the middle step fed early. To overcome premature feeding from this step, the reversed sprue portion was enlarged to a 2-in. diameter at the base and tapered to a 1-in. diameter at the top (Fig. 10C). The bottom step again fed very quietly. The middle step began to feed later than before, and the top step fed in sequence.

These systems show that sequence flow in step gates, as in the case of finger gates, can be obtained most readily by devices which dissipate the momentum of the incoming metal without producing localized pressure zones at the ingate junctions.

Pools and Offsets—Various systems were studied in which pools or offsets were used (Fig 11). It was thought that momentum effects could be eliminated by such means and sequential feeding obtained. However, pools caused strong premature feeding from the top step and flow was only occasionally observed from the lower steps. These tests indicated that the use of pools or offsets does not, per se, produce sequence flow.

Summary of Flow in Step Gates—The step gating systems in Figs. 7 through 11 show that sequence flow can generally be obtained by designs that absorb the momentum of the fluid stream or reverse the direction of flow. Of the systems studied, sequence flow was obtained most readily by the use of common junction

step gates (Fig. 9) and reversed sprue step gates (Fig. 10).

Hydrodynamics of Liquid Metal Flow—Gating of metal castings presents a complicated problem of fluid dynamics. In part, the flow of molten metal is that of a freely falling liquid under the influence of gravity. In part, it approximates the steady state flow of a fluid in a pressurized system. Both types probably are always present in any fluid system, but to a different degree depending on various factors. Frequently turbulence may also be present.

It appears from the observations reported here that certain established concepts of fluid mechanics could be used to advantage by foundrymen in designing gating systems. Gating systems in present use indicate that the importance of momentum effects is not appreciated. A realization of the importance of these effects for fluids of high density, such as molten metals, is imperative for proper design.

From a strictly mechanical viewpoint, casting into a mold involves simply the transfer of metal from a position of high gravitational energy to one of lower energy. Inasmuch as energies may only be changed in form but not lost, it follows that the decrease of gravitational energy of high position must occur by transfer to other forms of energy. The relationships involved are strictly defined by the Bernouilli theorem, which is one of the basic and classic laws of hydrodynamics. This law states that any fluid has an instantaneous energy which is composed of these three elements:

$$Et = Mhg + \tfrac{1}{2}Mv^2 + PV$$

= energy of position + energy of momentum + energy of compressive elastic action

where E = energy; h = height of fall; g = acceleration due to gravity; M = mass; P = pressure; v = velocity; V = volume

Analysis on a basis that the flow of molten meta's may be compared to the flow of water in the same channels is dangerous, even as a first approximation, for cases involving rapid flow. In these cases, such as shown for the initial entry of the metal along the empty channels, the velocity parameter of the $\frac{1}{2}Mv^2$ term (momentum) becomes the controlling factor of the equation since the pressure differential in incompletely filled channels is very low, and the PV term is therefore essentially zero.

Because of the importance of momentum during initial stages of pouring, it is reasonable to expect that the eightfold difference in the densi-

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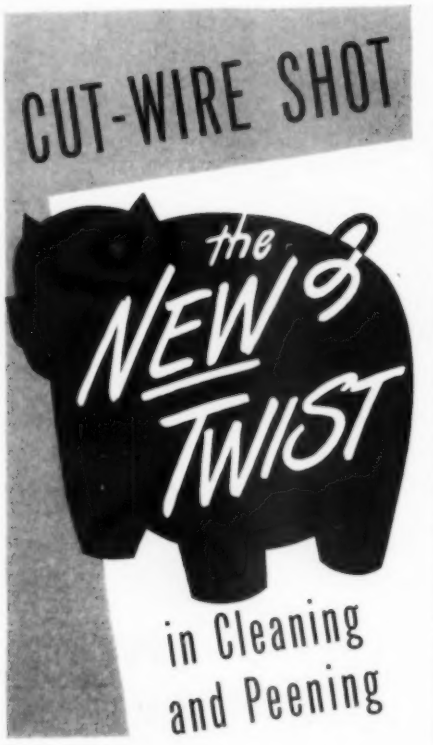

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ties of water and liquid steel should result in a greater dependence of steel flow on momentum effects. For conditions involving slow flow in completely filled channels, described as pressurized systems, it should be expected that momentum effects would be less important. Accordingly, fluids of similar kinematic viscosity but with different densities should behave similarly in slow flow.

Sprue Phase of Pouring—Development of Momentum—A unit mass of metal flowing from the sprue to the mold through a distance (h) will lose an amount of potential energy (hg) and acquire a corresponding amount of kinetic energy Mv^2 (where $v = \sqrt{2hg}$), except for frictional losses, which represent nonreversible losses of energy by the system to the mold proper.

It should be understood that the total energy of the fluid system is finally converted to heat and transferred as such to the mold. The total height (h) is not measured from either the pouring hole in the sprue cup or the point of entry into the mold, but is measured from fluid level to fluid level. The important fact is that (h) decreases during the pouring operation while the liquid levels change as the mold fills and the sprue cup empties.

Once the plug is removed from the sprue cup, the metal begins to fall freely with accelerated motion. It should then fall in a stream of decreasing cross section in keeping with the well-known hydraulic relation: $Av = Q$ (constant), where A is the cross-sectional area. This expression follows simply from the incompressibility of the fluid and the constancy of volume. Since $v^2 = 2hg$, A should change according to the relation: $A = Q/v = Q/\sqrt{2hg}$.

The velocity increase developed during the course of flowing down the sprue should theoretically result in a decreased pressure leading to aspiration of air. The importance of such aspiration in metal casting is not clear. True aspirator action can exist only when the metal stream completely fills the top of the sprue. When the metal is falling freely, but not completely filling the top of the sprue, even though (v) is increasing, no true aspirator action is to be expected because the pressure (p) is necessarily equal to atmospheric.

However, it is extremely unlikely that the falling stream falls free and unimpeded. Probably it strikes and restrikes the sprue walls to produce turbulent flow. Thus it is possible that frequently what has been considered free fall of the metal is really a combination of free fall and turbulent flow. Under these conditions in vertical systems, considerable gas may be mechanically trapped, carried into the mold, and replaced by additional gas or air drawn into the gate by a pseudo-aspirator or entrainment effect.

Runner Phase of Pouring—Development of Pressure Zones—The metal after falling through the sprue and entering the runner takes the most rectilinear path available and travels with increasing velocity (gravitational energy converted to kinetic energy) along the empty runner until the end of the runner is met. This is particularly evident in finger gating systems. A pressure wave is then generated at the point of impingement (kinetic energy is changed to energy of elastic compression) causing the farthermost ingates to feed prematurely and forcibly. The pressure then builds up along the entire system and, depending upon the geometry of the system, other fingers begin to feed.

Flow patterns observed from bent runner systems in finger gates indicate that the geometry of the system is critical in determining the effects of the pressure zone built up at the end of the runner. With the runner bent back from the casting at 45 degrees, the sharp change in direction at the junction of the fingers and runners causes increased flow resistance through the outer fingers, thereby producing uniform flow through all fingers.

When the runner is bent back only at a 30-degree angle, the change in angle of flow from runner to fingers is not sufficient to reduce appreciably the preferential flow in the outer fingers. The flow behavior observed when the runner is bent toward the casting is the result, at least in part, of splitting of the stream at the finger-runner junctions. In the case of the runner bent forward at an angle of 45 degrees, this tendency is pronounced.

Use of enlarged sections or pools appears to be a most promising means of obtaining uniform or sequence flow. These devices permit molten metal to lose a great proportion of the initial momentum without generating pressure zones and thus aid in producing uniform flow. Runner systems with impinging streams are apparently not as effective as others in producing uniform flow through finger gates because pressure wave effects are not eliminated.

Tapering may be used to control flow by frictional effects but its action appears to be more critical than

the other methods explored in these tests.

In most finger gating systems multiple ingates feed into the mold from a single downgate. It has been shown here that, in nonchoking finger gating systems having the total area of the ingates greater than that of the sprue, the ingates do not normally feed uniformly and require special geometrical features to do so. Whenever the total area of the ingates is less than that of the sprue, the metal should be expected to back (choke) in the gating system and produce uniform feeding. Such conditions approximate those of theoretical steady flow in pressurized systems. Investigations of such systems are in progress.

Past designs of step gates apparently have been based on the anticipation of slow, even rise of metal and have ignored momentum effects. When pouring conditions are predominantly those of slow, steady flow, step gates might be expected to function most nearly as hoped. Under these conditions it would be expected that the bottom step would feed alone until the liquid height in the sprue and in the mold increased together to the level of the middle step. Flow would then occur through the middle step as well as the bottom step. In the same way, when the top step was passed, all three steps should feed.

It is to be expected with conditions of slow steady flow that momentum of the down-stream is unimportant. When flow is rapid, as in most pouring operations, it is to be expected, however, that the momentum of the stream will carry it past lateral openings (follow rectilinear path of least resistance) to the bottom of the sprue. The metal will then feed most heavily through the bottom step through the entire casting operation unless sharp angles, baffles, or entrapments are incorporated into the system to dissipate momentum and pressure effects.

Mold Entry Phase of Pouring—Development of Turbulence — The design of gating systems, as has been pointed out in this and the previous report, has a profound influence on the turbulence in a casting. Previous work showed the existence of at least two modes of turbulence in finger gates—swirling and rolling turbulence. The investigations recorded here show that a third form, called here rocking turbulence, exists. This type of turbulence results from intermittent feeding through finger gates.

The effects of turbulence, per se, on the properties of castings are not

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known. Such a study was outside the immediate scope of this investigation. Inasmuch as mold turbulence proved to be an excellent indication of feeding conditions it was used chiefly in this study to determine the uniformity of feeding through the finger. The fact that mold turbulence depends on the gating system indicates that such turbulence can be controlled by the feeding sequence and pattern.

Conclusions—Results of these studies of flow in terms of established hydrodynamic concepts require cautious interpretation, since the idealized conditions of lamellar flow in true pressurized systems are seldom met. Actually, flow conditions are continually changing during pouring. The initial entry of metal into the gating system approaches free fall, but as the system fills, a ferrostatic back pressure is developed and the action approximates that of a pressurized system.

The conditions of first-stage pouring place a predominate importance on momentum and related pressure effects. This stage of flow should therefore be dependent on the specific densities of the liquid.

Second-stage pouring occurs through the development of back pressure; during this period the flow approaches that of a pressurized system. In this stage momentum-pressure effects are reduced and density differences should necessarily be less important.

These studies have shown that uniform or sequence flow may be obtained (1) by elimination of pronounced momentum-pressure effects by use of enlargements, and (2) by control of momentum-pressure effects to aid proper feeding by sharp angles, constrictions or increased flow distance.

Finger gates of special design are required to secure uniform flow. These gates either split the fluid stream into equal parts or absorb the momentum in the runner. Absorption of momentum is most effectively obtained by the use of pools in the runner and with lesser success by bending the runner away from the casting, or by using a tapered runner.

Commonly used step gates cannot be relied upon to produce sequence flow except by modifications using special devices. Studies of single junction and multiple junction steps in step gating show that inclination of the bottom step promotes sequence flow for the two bottom steps. Tapered sprues may also be used, but these are exceedingly critical and no example of full sequence flow was actually obtained by such devices in this investigation.

Turbulence arises from the flow patterns produced by the gating systems. In the investigation to date, three forms have been observed. These are (1) swirling, produced by unequal feeding; (2) rolling, produced by uniform feeding and (3) rocking, produced by intermittent feeding.

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Editor's Note: This report also was presented at the annual meeting of the American Foundrymen's Society in Cleveland, May 12.

QUALITY CONTROL OF ALUMINUM CASTINGS

(*Continued from page* 67)

analysis of either the castings or of separate samples, leak testing, and fluorescent penetrant inspection. Since these methods do not damage the castings, they can be used on all or any part of a lot of castings to determine their conformance to specifications.

In the earlier discussion of foundry practices the effect of gating on strength was mentioned. The application of radiography in developing gating is shown in Fig. 8, depicting an unsound casting along with a gated casting, the improved gating and a radiograph showing the casting to be sound. In addition to its use in development of gating and other plant practices, radiography is also employed as a routine inspection method for certain critical jobs.

Fig. 1 shows a procedure for pressure testing a casting for leaks. This involves use of a soap solution over the outside of a casting into which air is injected at controlled pressure. Another check for leaks involves immersion of the casting in water while introducing air into the casting at controlled pressure.

Fig. 7 illustrates an arrangement for proof testing a base casting for a portable road scale. In this test, strain gages are used to measure strains which occur during loading, and dial indicators measure the deflection under load, as well as the permanent set of the casting after the proof load has been released. This test, where it is applicable, is a good

measure of a casting's ability to withstand service requirements.

All the inspection methods mentioned and illustrated provide certain specific information as to the quality of the castings being inspected. No single one, however, is capable of telling the complete story. It is only by careful use of a combination of several of the individual procedures that the foundry can be assured that the desired quality is being manufactured into its product.

Role of Statistics—In the preceding discussion of inspection methods, mention was made of 100 per cent inspection and examination of representative lots of castings. Unfortunately, 100 per cent inspection may be frequently less than 100 per cent effective. This is especially true where large lots are being inspected and the job becomes monotonous and uninteresting. When properly selected, a representative sample will frequently tell more, at less expense, than will 100 per cent coverage.

Too often, however, a specific percentage of castings may be taken for inspection regardless of the lot size from which they are to be selected. Fig. 6 shows the fallacy of this type of sampling. From this illustration it can be seen that by taking a 10 per cent sample of a lot of 100 castings containing 5 per cent defectives, the entire lot would be accepted 60 per cent of the time on the basis of no defectives appearing in the sample. Contrariwise, a 10 per cent sample of a lot of 1000 castings containing the same 5 per cent defectives would result in acceptance of the lot only about 1 per cent of the time. It is here that statistics and statistical analysis can help in selecting sample sizes to achieve a calculated risk, in determining the variations to be expected in foundry processes, and in keeping production under control.

All are aware that it is not possible to make 100 castings, or 100 baseballs, or 100 of anything and have all alike in every detail. However, 100 castings can be made the same within certain limits, if the process is controlled throughout the period when the castings are being produced. From the mathematical laws of probability, it can be shown that the various forms in which a given event occurs will, over a period of time, align themselves to form what is known as a normal distribution curve. By compiling data on the diameter of cast piston, for example, over a period of time, such a normal distribution curve can be developed. These data can then be used to prepare a control chart as shown in Fig. 4. Here the normal distribution

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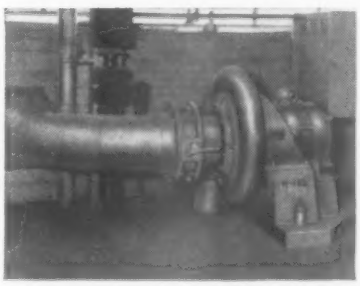

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curve is rotated 90 degrees. The dashed line marked $\overline{X}$ (bar X or X bar) represents the average or arithmetical mean of the observed diameter measurements which developed the curve. The value of sigma (σ) is the root-mean-square deviation of the numbers from their average and is expressed algebraically as:

$$\sigma = \sqrt{\frac{(X_1 - \overline{X})^2 + (X_2 - \overline{X})^2 + \ldots\ldots + (X_n - X)^2}{n}}.$$

The area under the curve between $+3\sigma$ and -3σ represents the area in which 99.73 per cent of all diameter measurements for the particular castings would fall while the process was in control. Using the plus and minus 3 σ values as upper and lower control limits for a chart, it is then possible to inspect future castings for diameter on the basis of this control chart. If all of the diameter measurements taken on subsequent castings fall within these control limits, it is known that the factors affecting this measurement are in control. If some values fall outside the limits, it is a signal that something has happened to disrupt the normal pattern and that steps should be started to check the various factors involved.

As has been pointed out, the control chart is a measure of the capabilities of a process as it is currently operating. In many instances, specification tolerances may be found to be substantially wider than normal process tolerances. In such cases, savings may be possible by altering procedures so that advantage can be taken of the wider tolerances. Or, on the other hand, the more closely controlled product may command a better price. Conversely, such charts may occasionally indicate tolerances closer than present procedures are capable of maintaining. In such cases, changes in existing procedures are indicated unless a very high percentage of rejections is to be accepted.

Control charts can be very helpful in regulating processes and in maintaining quality level. Again, however, the question of sampling must be considered. Since 100 per cent inspection is to be avoided wherever possible, it is necessary to develop a sampling arrangement that will assure the quality level desired. As was seen earlier, the effectiveness of percentage inspection depends to a large degree on lot size and will not always provide the desired results. Here again the use of statistical analysis can be of assistance. Tables for the development of statistical sampling plans have been published by the U. S. Army Ordnance Department, U. S. Navy, the U. S. Army Quartermaster Department, and Dodge and Romig.

Fig. 5 is an example of such a sampling plan. In this plan, a sample of 150 castings is taken from each lot of from 800 to 1300 castings. The acceptance number (c) is 2 and the rejection number (r) is 3. That is, the entire lot is acceptable if no more than two defective castings are found in the sample of 150. Conversely, if three or more defective castings are found in the sample, the entire lot must be rejected for 100 per cent detail inspection. Operating on this particular sampling plan means acceptance of any lot containing 0.60 per cent defectives 95 per cent of the time.

Thus, the Acceptable Quality Level (AQL) is 0.60 per cent. The Lot Tolerance (Pt) is 3.65 per cent; which means acceptance of any lot containing 3.65 per cent defectives 10 per cent of the time. From this can be established an Average Outgoing Quality Limit (AOQL) of 0.96 per cent, which indicates that over a period of time the limit of the average number of defectives sent to a customer would not exceed 0.96 per cent providing that all lots rejected by the plan are detailed and the defective castings replaced with acceptable ones.

The plan described here is one of many in the books of plans published by the various agencies and individuals mentioned. By proper selection of the sampling plan, any quality level for shipment that seems to be satisfactory for the particular job, can be provided.

Use of control charts and sampling plans is not a panacea for all foundry ills. They will not, of themselves, keep processes under control and scrap down. They do, however, provide the necessary information to enable a foundry to keep its processes under control and find the cause of trouble before it is out of hand. Further, the use of statistical analysis can reduce inspection costs while, at the same time, give assurance that a better product, on average, is shipped.

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Editor's Note: This paper was presented before the third annual Ohio Regional Foundry Conference in Cincinnati, Mar. 10, 1950.

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(*Continued from page* 87)

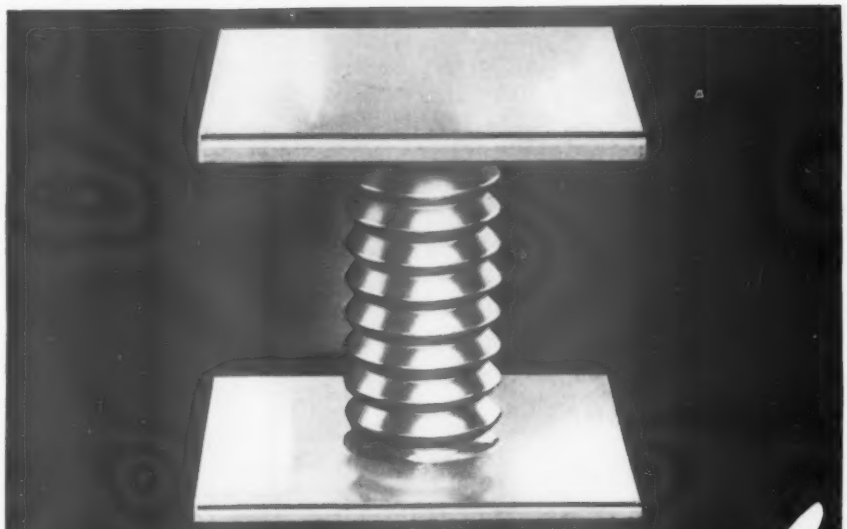
trunnion has two ½-in. steel rods cast in and projecting a short distance from the free or contact face. A steel plate with corresponding holes, is attached to each end of the pattern board on a center line. The two trunnions, one on each side, are attached by inserting the rods into the holes. The pattern board then is lifted and transported to or from the molding machine, or to and from the special storage room on the second floor, by a beam and pair of slings suspended from the monorail. Having served their purpose the portable trunnions are removed for use elsewhere.

Active pattern boards waiting transportation to storage are parked on edge on small dollies. They are parked in pairs, touching along the top edges but separated at the bottom by the width of the dolly. The arrangement provides stability, keeps the patterns clean and prevents distortion or possible accident. Outgoing pattern boards are carried aloft in a large freight elevator and delivered to the storage room. A hoist on a transfer crane with beam and slings carries them to their allotted space and suspends them from trolleys on the overhead monorail tracks.

Describes Molding Equipment

Molding equipment includes 1 sandslinger, 3 roller ram machines, 12 jolt rollover pattern draw machines and 32 squeezers. The jolt machines range in lifting capacity from 750 to 10,000 lb., including four 750 lb, four 1500 lb, two 3000 lb, one 6000 lb and one 10,000 lb. Molds from the sandslinger and the roll ram machines are placed on the floor. Molds from the other machines are placed on roller conveyor lines.

The conveyor unit serving the battery of 32 squeezers, 16 on each loop, incorporates four trains of 16 cars on each loop. The cars are pulled by small electric locomotives operated on the third-rail principle. This permits the trains to halt temporarily at the molding station, the pouring station and in the cooling tunnel. At the shakeout station an automatic switch diverts the locomotive and train to a section of the conveyor where the load is moved slowly by reduction gear, chain and sprocket to give the shakeout operator time to dump molds and castings into a chute and screen and on to a steel apron conveyor which carries the castings and sand to a shakeout. Here



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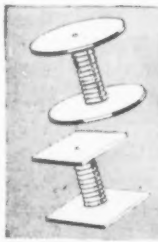

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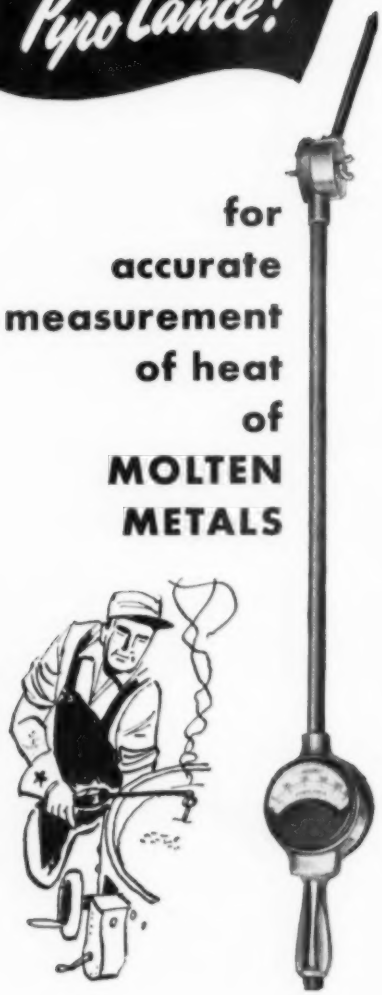

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the sand falls to a belt with a magnetic pulley, then is elevated to a revolving screen, and thence into a large storage hopper.

Fragile castings are diverted around the shakeout. The men at the dump stations dump these molds onto vibrating screens which return the sand to the apron conveyor while the fragile castings receive special handling by monorail and are then transferred to the castings conveyor. A mark on the cope of these molds tells the dump man which molds contain fragile castings.

Cycle Controlled Automatically

By the time the last molds are dumped, the locomotive at the head of the train has advanced to a point approximately opposite the dump station and the last car is clear of the chain drive. The locomotive then automatically makes contact with the third rail and moves at greatly accelerated speed to the area served by the molding machines where it halts for 5 minutes while the molders are placing molds on the cars. Automatically at a given signal the train moves forward to the pouring station where it again halts for 5 minutes. When the molds are filled with metal, the train again travels rapidly around the turn and into the cooling tunnel where it remains stationary for another 5 minutes. (Each train takes one minute in moving from station to station.) Then it moves forward again on the last lap of the journey to the point where the switch diverts the train to the short chain-driven section where the molds are shaken out.

The entire cycle is controlled automatically. If necessary, the speed may be set in advance to meet variation in the mold production unit. Under ordinary conditions the six-minute cycle is the most efficient. While the movement of only one train has been described, each loop of the conveyor has accommodation for four trains which follow each other in orderly sequence. Total length of each loop of the elliptical conveyor is 500 ft. Each loop operates 75 trains per day (10 per hour for a 7½-hour molding day), and the total daily mold production will result in approximately 7000 molds from the 32 molders, of whom usually two normally work on short orders (15 flasks or less). The remaining 30 molders work about 60 per cent of the time on matchplate jobs and the balance is spent on loose pattern jobs.

Sand from the shakeout is carried aloft in a bucket type elevator and discharged through a revolving screen into a storage hopper from which it is fed as desired to a muller type mixer, then to a belt which carries it over the center of the molding stations. A series of plows divert the sand stream to the various hoppers over the molding machines set up on both sides of a central gangway. Through bond, permeability, moisture content and grain size tests carried out in a well equipped laboratory the quality of the sand is controlled closely, as shown in Table II.

Hot castings are discharged from the shakeout into trays on a chain type overhead monorail to the sprueing and sorting area. Here the sprues and gates are tossed into a bin directly under the charging floor magnet crane. The castings are rough sorted according to type of cleaning. After airless blast cleaning the castings are taken to the snagging department where they are inspected and ground and then carried by tote pans on roller conveyor to the stock room where they are stored. Later, on requisition, the castings are taken to the various machine shops for machining and assembly into the finished product.

(To be concluded next month)

STEEL FOUNDRY CORE AND MOLDING SANDS

(Continued from page 75)

give the sand the necessary green strength. The amount used depends upon the green strength required. Small cores turned out in drying frames naturally can be made of sands having a low green strength, since they do not have to support themselves until they have been dried. For larger complicated cores that must be bedded in and rolled over by hand, the sand must be much stronger. Cores such as those that make up the molds for centrifugal pump impellers, examples of which were shown in Figs. 71 and 72 (THE FOUNDRY, March 1949, page 96) must be made of sands that will not sag away from the supporting arbors when the box is removed and the core transferred to the drying oven.

The proportion of core oil to sand depends upon the amount of dry strength required, and varies all the way from a ratio of 1 part oil to 20 parts sand by volume—roughly 7½ gallons of oil per ton of sand—to as low as 1 part oil to 100 parts sand, or about 1½ gallons of oil to the ton of sand. Table V, based upon the assumption that a cubic foot of sand weighs 100 lb, shows the amounts of oil required per ton of sand, for various ratios of oil to sand by vol-

ume. Figures in this table differ somewhat from those given by Dietert[15], because he assumes a weight for sand of 14.5 lb per gallon, whereas a weight of 100 lb per cubic foot corresponds to 13.36 lb per gallon.

In the general run of oil sand cores used for light to medium section steel castings, a ratio of 1 of oil to 80 of sand, by volume, is a fair average of American core shop practice, and in cores of this sort, nothing

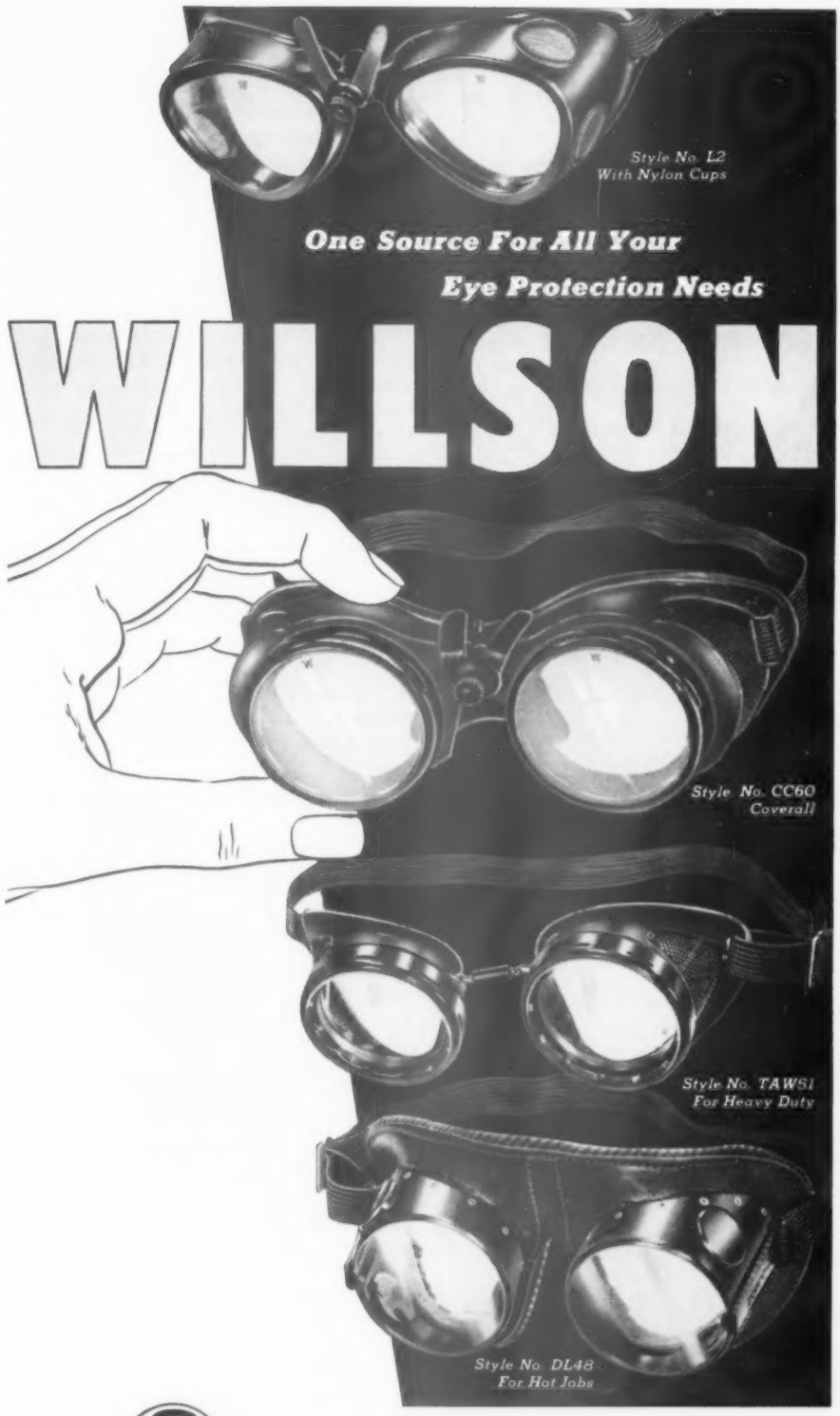
TABLE V—OIL-SAND PROPORTIONS

Volume Ratio Oil to Sand	Gallons Oil Per Ton Sand
1 to 10	14.96
1 to 20	7.48
1 to 30	4.98
1 to 40	3.74
1 to 50	2.99
1 to 60	2.49
1 to 70	2.14
1 to 80	1.87
1 to 90	1.65
1 to 100	1.50
1 to 110	1.36
1 to 120	1.25
1 to 130	1.15
1 to 140	1.07
1 to 150	1.00

is mixed with the sand except cereal or other binder to provide the necessary green strength. Clay or bentonite is not generally used with the oil and cereal, since they give high hot strength to the sand and hence diminish collapsibility. In cores of this sort there is generally little or no chance of serious penetration, and the sand should have a high permeability.

When the core is to form a comparatively small opening in a heavy section of steel, however, penetration is certain to occur unless means are taken to greatly reduce its permeability. The most obvious way to do this would be to use sand of very small grain size since the permeability of the finer sands is much lower than that of coarse ones. To stock sands of many different grain sizes is out of the question in the average shop, and the usual way to vary the core sand permeability to suit the job, is to add silica flour.

Silica flour is made by grinding pure quartz sand to the fineness of flour. It usually is air or water floated to eliminate most particles coarser than 200 mesh. In oil sand core mixtures, silica flour is used in proportions from 4 or 5 per cent to as high as 30 per cent of the combined weight of the sand plus the silica flour. As the proportion of silica flour is increased, the amount of oil required to give the sand the proper strength also increases, because the surface area to be covered with the oil film is greater with a higher proportion of fines. Were clay or bentonite incorporated in the sand, extra oil would be required,



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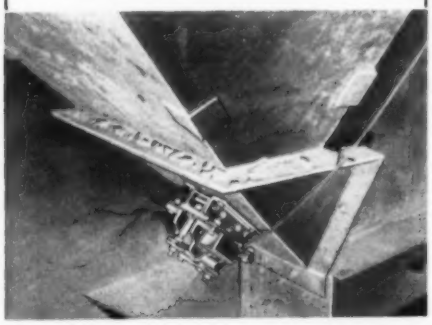

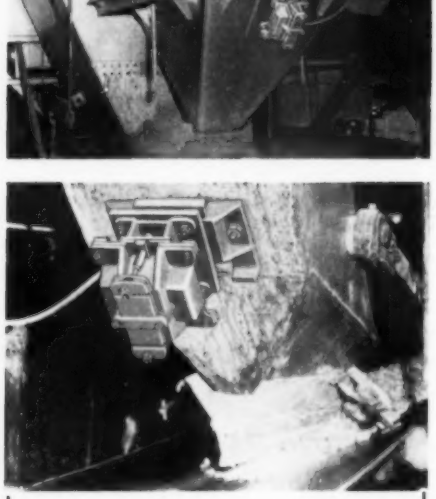

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just as when silica flour is used, but cereal binders do not absorb oil in the same way.

The higher the proportion of silica flour in a sand mixture, the lower the permeability. Dietert[19] states that the higher the proportion of silica flour (and of the necessary core oil), in the sand, the greater the green strength, the lower the flowability, the higher the strength at high temperatures and the higher the sintering point. The decrease of permeability and the increase of sintering point and hot strength, with higher proportions of silica flour, make the sand more resistant to penetration by the steel.

In extreme cases, in order to secure adequate resistance to metal penetration, as much as 60 per cent silica flour, or even more, may be used in a core sand mixture. Sometimes even such mixtures as this will not meet requirements, and instead of a sand core, a piece of steel pipe of the proper size (usually "extra heavy"), is rammed full of a mixture of sand and silica flour and set in the core prints. When holes of irregular outline must be cored in heavy sections of steel, it is sometimes necessary to make thin-walled hollow cast steel pieces of suitable shape, ram them full of sand and silica flour, and use them in the same way as cores or pipe. Curved holes of uneven cross section in heavy cast steel steam hammer anvils, rolling mill housings and similar castings, have been successfully formed in this way.

Sometimes sand cores that are to be surrounded by very heavy masses of steel are protected from penetration by enclosing them in a basket made of thin pieces of perforated steel plate, wired together, and spaced an inch or so away from the core by means of chaplets. Copper flashed or nickel flashed steel plate is the best for the purpose, and it should have holes about ¾-in. in diameter punched in it, to allow the steel to flow freely into the space around the core. This internal chill so reduces the temperature of the steel in immediate contact with the core that penetration is much less likely to occur.

Washes—In addition to spraying dry sand cores and molds with solutions of lignin and other water-soluble binders, it is often desirable to coat them with one or more layers of a slurry or wash. This may be applied with a swab, but an air-operated atomizer that breaks the wash up into a fine spray and spreads it evenly over the surface of the mold or core, gives a more uniform coating and is much preferred.

The base material of a wash is usually silica flour, which is mixed with water and small amounts of bentonite and water-soluble binders such as molasses or lignin, to form a comparatively thin slurry. Various proprietary materials available are mixed with silica flour and water, and are so compounded as to keep the solid matter in suspension with little stirring, and many foundrymen find it advisable to use these prepared materials instead of making up their own compounds.

Cores and molds are usually washed before drying, and sometimes are sprayed a second time, either while still warm from the oven or after they have cooled. In the latter case they should be given a second short drying, either in the oven or with an oil or gas torch. The wash forms a coating over the surface of the sand, with so low a permeability that if only it would remain completely unbroken, penetration would be prevented entirely. Unfortunately, it is not possible for both the coating and the underlying sand to expand at the same rate or to the same degree when heated by the liquid steel, and the coating often cracks.

A poorly compounded wash may even flake off in many places, leaving considerable areas of sand exposed. A less extreme condition results only in the formation of cracks, through which the steel will seep, especially where light bodies of sand are nearly surrounded by heavy masses of steel. In many cases examination of polished cross sections of the steel and the adhering layer of sand-steel compound has definitely proved that penetration occurred in this way. In these specimens the coating was seen to be still in place, separating the steel from the sand, but to be pierced in numerous places by thin stringers of steel that flowed through cracks in the coating and seeped into the underlying sand.

(To be continued next month)

References

18. H. W. Dietert, *Modern Core Practices and Theories*, page 129.

19. H. W. Dietert and Gordon Curtis, "Silica Flour Controls Molding Sand", THE FOUNDRY, September, 1941, page 58.

Win Safety Awards

Three departments of the Commonwealth Plant, General Steel Castings Corp., Granite City, Ill.—pattern department, welders and burners, and inspection department—were honored recently for outstanding safety records by American Mutual Liability Insurance Co., Boston. Safety certificates were awarded the groups for having achieved one full year's operation and the accumulation of 250,000 safe man-hours.

OBITUARY

WILLIAM E. PAULSON, president, Thomas Paulson & Son Inc., Brooklyn, N. Y., engineers and founders, died May 31 at his home in Plandome, L. I. Mr. Paulson was graduated from Stevens Institute of Technology in 1904 with a degree in mechanical engineering. He was associated with Westinghouse Electric Corp., Pittsburgh, and Consolidated Gas Co., New York, until 1910 when he joined the company which his father organized in 1883. Following his father's death in 1928 he became president.

WILLIAM E. PAULSON

* * *

Harry P. Hubbell, 78, president, Semi-Steel Casting Co., St. Louis, died May 15. Mr. Hubbell went to St. Louis in 1891 as representative of eastern iron, steel and copper mills. In 1923 he organized the steel sales partnership of Hubbell & Co., of which he was senior partner at the time of his death. In 1926 he organized the Brass & Copper Sales Co., retaining the board chairmanship.

* * *

John C. Stiefbold, foundry superintendent, De Laval Steam Turbine Co., Trenton, N. J., died Apr. 29. Mr. Stiefbold joined the company in 1909.

* * *

George H. Marquard, 64, founder and secretary-treasurer, Hoffman-Marquard Iron & Machinery Co., St. Louis, died May 31.

* * *

Howard M. Doty, 76, formerly secretary-treasurer, Reading Steel Casting Co., Reading, Pa., died May 22 in Philadelphia.

* * *

Earl B. Pridmore, 49, for the past 7 years plant superintendent, International Molding Machine Co., La Grange Park, Ill., died in Chicago, May 13. Mr. Pridmore, who had been associated with the molding machine business for 25 years, began his career with the Henry E. Pridmore Machine Co., Chicago, which his father founded.

* * *

Isadore Sturrock, 70, for the past 20 years foundry foreman, Anaconda Copper Co., Great Falls, Mont., died Apr. 24

* * *

C. D. Maddox, 44, secretary-treasurer, Maddox Foundry & Machine Works Inc., Archer, Fla., died May 21.

* * *

Alfred W. Gregg, 66, consulting engineer, Whiting Corp., Harvey, Ill., died June 8, at Columbia Hospital, Milwaukee, following a short illness. Mr. Gregg was born in Riverside, Ill., and was graduated from Purdue University in 1904. Following a year as assistant chemist with Latrobe Steel & Coupler Co., Melrose Park, Ill., he was associated for 15 years with Bucyrus-Erie Co., South Milwaukee, and with Bonney-Floyd Co., Columbus, O., from 1929-1936. He was foundry superintendent for Whiting Corp. from 1919 to 1923 and rejoined the company in 1936 as executive engineer in the foundry equipment department. Mr. Gregg, who was recently elected president of the Chicago Chapter of the AFS for the year 1950-51, was awarded the John H. Whiting Gold Medal of that organization in 1944 in recognition of his outstanding contributions to the foundry industry.

ALFRED W. GREGG

* * *

David R. Gould, founder and president-treasurer, General Aluminum Mfg. Co., Cleveland, died June 8, at his home in Rocky River, O.

* * *

Edwin P. Eiffes, purchasing agent, the Adams Co., Dubuque, Iowa, died Apr. 14.

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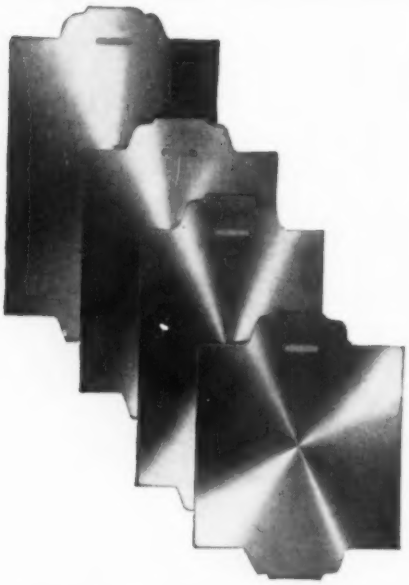

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With the EDITORS

EDITORS' SOCIETY: Many friends in the industry frequently comment on the tremendous amount of traveling undertaken by the editors to attend and report meetings of various groups in the foundry and allied industries. We do travel thousands of miles each year and attend several hundred technical and management meetings, but we enjoy greatly the privilege of visiting with foundrymen from the different sections of the country.

However, our thirst for attending meetings is not confined entirely to the castings industries. For example, we participate in the affairs of groups considering the problems of editing and publishing. One of the most important is the Society of Business Magazine Editors, a professional organization in which the editors hold membership.

This society holds frequent conferences in Washington and other cities with important officials in government and industry. Through these off-the-record talks, the editors secure background information of considerable value in creating a better picture of future trends and how these may affect the industry served by the individual publication.

Of course, one of the aims of this professional society is to help editors do a better job in their respective fields. To that end, the society has adopted the following code of ethics:

A Code of Ethics
For the Business Magazine Editor

I believe in and seek to practice:

Editorial Accuracy. With reader interest as the paramount responsibility, I shall report objectively, facts as I find them . . . seeking always to lend strongest support to the business, profession or industry I serve.

Editorial Judgment. Because the publication of injudicious, unfair or untrue statements undermine honest business magazine editorial practice, I shall judge wisely the words I print.

Editorial Competitiveness. While I respect the rights of other editors and honor copyright privileges, I believe in full freedom of the press and in editorial initiative.

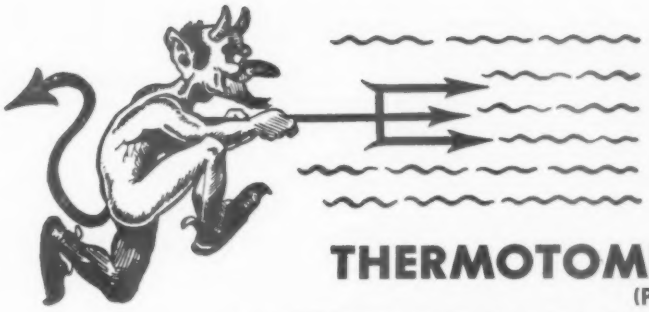
Editorial Service. My publication serves a fundamental purpose in stimulating the flow of goods and services . . . therefore, I direct my effort to building a fount of data for my readers. To them I devote the sum of my knowledge and the accumulated experience of the publication I edit.

Editorial Leadership. I shall endeavor to stimulate my readers to constructive thought and action on vital issues affecting them so that my magazine may bring enlightened leadership in its field.

—o—

Accident and Recovery: European Editor Vincent Delport and Mrs. Delport recently were in an automobile accident just outside London when returning from a week-end visit to Manchester. Both were shaken up considerably and suffered deep cuts and bruises. Latest news from London indicates complete recovery, and that Vincent is off to Buxton for the annual conference of the Institute of British Foundrymen. His report on that meeting will be printed in the August issue. —F.G.S.

Editors of Penton Publications—THE FOUNDRY, *Steel, Machine Design* and *New Equipment Digest*—recently spent two productive days visiting a number of departments of the Westinghouse Electric Corp., including the foundry at Trafford City, Pa. Bill Gude and Frank Steinebach represented THE FOUNDRY.



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THERMOTOMIC is a patented Exothermic compound that can be molded into any desired shapes and used as feeding inserts under risers or as facing application where it is desired to maintain fluidity of the casting metal. THERMOTOMIC permits reversal of the trend towards large feeding heads and risers, making it possible to use heads that are shorter and more compact with very small feeder openings. This permits easy removal of heads and gates and sharp reductions in cleaning and finishing costs. When THERMOTOMIC is used as inserts or as facing in the mold, heat at thin metal sections is retained until the main body of the casting has solidified, thus eliminating shrink cracks and improving grain structure and tensile strength.

Monel Casting
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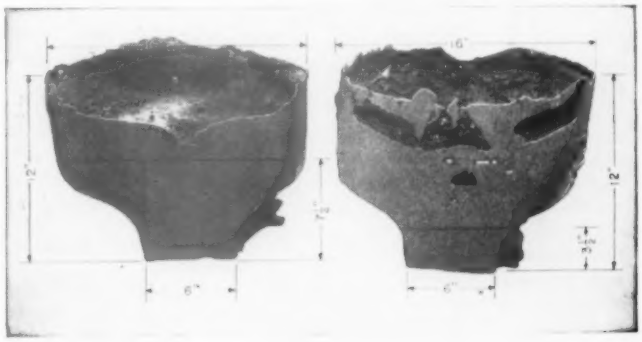
Made by direct pouring through the Thermotomic strainer core under the feeding head.

No chills were used, no shrinkage at the flange. Note depth of shrinkage in the feeding head.



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FACING MATERIAL: Smith Facing & Supply Co., 1857 Carter Rd., Cleveland 13—Booklet describes a new facing material designed to eliminate many common sand defects and to stabilize foundry sands. It is a partially carbonized cellulose which, when added to sand, is said to control the expansion properties, eliminate scabs, buckles, rat-tails, and to improve casting finish.
For More Details Circle No. 90—Page 191

POWER TOOLS: Walker-Turner Division, Kearney & Trecker Corp., 639 South Ave., Plainfield, N. J.—Catalog A on heavy power tools for wood, metal and plastic gives complete specifications and operating conditions for each machine. Descriptions of band, radial and tilting arbor saws, drill presses, jointers, lathes and shapers, surfacers and flexible shaft machines are given.
For More Details Circle No. 91—Page 191

SANDCUTTERS: American Wheelabrator & Equipment Corp., 3 South Byrkit St., Mishawaka, Ind.—Catalog 20-A contains information on a heavily constructed sand conditioning machine recommended for use on medium to heavy foundry floors. The machine is built in four standard sizes, with cutting cylinders ranging from 50 to 78½ in. long.
For More Details Circle No. 92—Page 191

ELECTRODES: Hobart Brothers, Hobart Square, Troy, O.—Catalog EW-149 presents description, data on application, welding procedure, mechanical properties and specifications of electrodes in the company's line. Included are electrodes for mild steel, cast iron, nickel manganese, aluminum, special purpose, hard surfacing, tool and die, and gas welding.
For More Details Circle No. 93—Page 191

HEAT EXCHANGE: Kold-Hold Mfg. Co., 602 East Hazel St., Lansing 4, Mich.—Bulletin IP-1049 describes a new coil method of heat exchange which takes less tank space yet heats faster than ordinary pipe, it is claimed. Advantages are described in relation to savings in time, money and manpower for the user. Typical installation and specifications are shown.
For More Details Circle No. 94—Page 191

MANAGEMENT AUDIT: Wallace Clark & Co., Management Consultants, 521 Fifth Ave., New York 17—Brochure entitled "Management Audit—An Appraisal of the Dynamics of a Company," outlines procedures, defines duties, delegates authority, and shows how responsibilities can be divided to free management for more creative thinking and planning. Proposed organization charts, recommendations for simplification of work and new methods of operation control are suggested.
For More Details Circle No. 95—Page 191

IDENTIFICATION TAGS: Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh 13—Circular 49-14 furnishes information on installation of safety check system for industrial plants. Metal identification tags in an assortment of 26 shapes for use on valves, junctions and exposed portions of pipe lines, are available in National Safety Council recommended code colors.
For More Details Circle No. 96—Page 191

LIFT TRUCKS: Lewis-Shepard Products Inc., 263 Walnut St., Watertown 72, Mass.—Bulletin 26 gives complete details, specifications and engineering features of lift trucks in capacities from 500 to 15,000 lbs. Installation pictures show adaptability of various types of trucks and suggestions are offered for construction of platforms for special purposes.
For More Details Circle No. 97—Page 191

GYPSUM CEMENT: United States Gypsum, Industrial Sales Division, 300 West Adams St., Chicago 6—Bulletin IGL-103 gives a picture story on making pattern shapes of gypsum cement and casting predetermined thickness slabs. Bulletin IGL-23 offers directions for mixing, using and handling gypsum cement. Bulletin IGL-18 covers parting compounds for gypsum cements.
For More Details Circle No. 98—Page 191

WELDING ALLOYS: Eutectic Welding Alloys Corp., 40 Worth St., New York 13—Illustrated folder discusses welding rods and electrodes, including a new line for stainless steel welding. Selection chart provides information on everyday and specialized welding alloys. Case histories of specific welding operations are presented.
For More Details Circle No. 99—Page 191

COLLOIDAL GRAPHITE: Acheson Colloids Corp., Port Huron, Mich.—Bulletin 425 deals with the use of colloidal graphite dispersed in fluid carriers as a coating for permanent molds, patterns, flask pins, shoulder screws, ladle interiors and chills. Coating is said to reduce friction on the surfaces covered and to aid in producing castings of good reproduction and smooth surfaces.
For More Details Circle No. 100—Page 191

SPEED REDUCERS: Cleveland Worm & Gear Co., 3295 East 80th St., Cleveland 4—Bulletin 125 pre-

sents new vertical speed reducers with downward or upward gear shifts, suited to such equipment as agitators and mixers, and for use in connection with supplementary low-speed spur gear drives, without outboard bearings. Complete dimensional data, cross-section drawings, thrust and overhung load capacity charts on these and other vertical units are included.
For More Details Circle No. 101—Page 191

REFRACTORY JOINTING MATERIAL: Laclede-Christy Co., 200 Iroquois Bldg., 3500 Forbes St., Pittsburgh 13—Bulletin 101A discusses a refractory jointing material developed for laying up fire clay brick subjected to excessively high temperatures, skulls, and slags due to molten metal oxides. It also may be used as a protective coating and for filling cracks or crevices.
For More Details Circle No. 102—Page 191

GRAPHITIZER: United States Graphite Co., 1621 Holland St., Saginaw, Mich.—Bulletin deals with graphite used as a graphitizing ladle addition to gray iron to reduce chill in iron castings, increase machinability, and improve strength, toughness, wear and shock resistance. It illustrates and describes methods of addition and special effects achieved.
For More Details Circle No. 103—Page 191

DIE CASTING MACHINE: Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12—Bulletin covers a new model high-pressure hydraulic die casting machine, available as a gooseneck or cold chamber model. Speed, rigidity, accessibility and ability to stand up under trying operations are emphasized.
For More Details Circle No. 104—Page 191

SAFETY EQUIPMENT: General Scientific Equipment Co., 2700 West Huntington St., Philadelphia 32—"Everything in Safety," a catalogue of personal protective equipment and industrial safety devices, covers respiratory units, eye protection, hats, gloves, drum and carboy pumps, etc. Price list is included.
For More Details Circle No. 105—Page 191

HOISTS: American Hoist & Derrick Co., 63 South Robert St., St. Paul 1—Catalog 100-H-40 covers general purpose hoists from 5 to 40 hp and catalog 100-H-55, from 50 to 100 hp. Both are illustrated with operating pictures and illustrations of mechanical parts and assemblies.
For More Details Circle No. 106—Page 191

IRON ALLOYS: Vanadium Corp. of America, 420 Lexington Ave., New York 17—Bulletin describes two chromium alloys balanced with manganese and silicon for use as additives to gray cast iron. Purpose and application of the alloys is discussed and charts show results of varied additions. Another alloy, containing silicon, titanium and calcium, for use as a graphitizer and deoxidizer of

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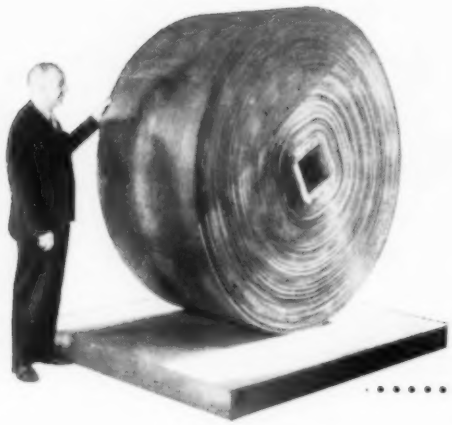

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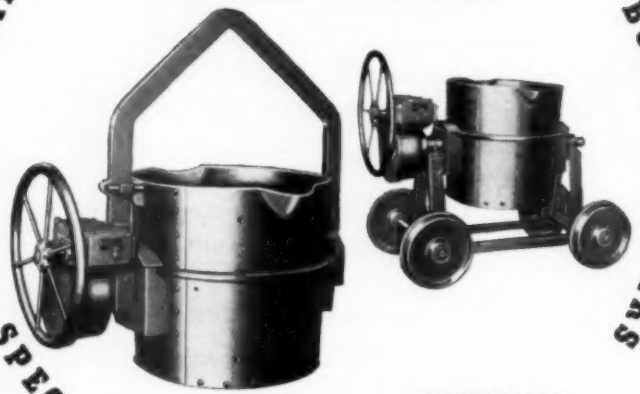

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gray iron is discussed in a second leaflet.
For More Details Circle No. 107—Page 191

CAR PULLER: Silent Hoist & Crane Co., 885 63rd St., Brooklyn 20, N. Y.—Bulletin 64-A illustrates and describes a capstan car puller and barge mover and outlines method of calculating pounds of pull required to move loaded cars on the level, grade or curve.
For More Details Circle No. 108—Page 191

DESCALING: Hooker Electrochemical Co., Buffalo Ave. & 47th St., Niagara Falls, N. Y.—Bulletin 25 describes a salt descaling process for descaling stainless and other alloy steels and desanding, degreasing, degraphitizing and drawing operations on a wide range of ferrous metals.
For More Details Circle No. 109—Page 191

CONVEYOR BELTING: Carlyle Rubber Co., 64 Park Place, New York 7—Booklet on rubber conveyor belting gives valuable information on receiving and storage, installation, splicing and maintenance. Directions for repairs and equipment required also are given.
For More Details Circle No. 110—Page 191

HOISTS: American Chain & Cable Co., Wright Hoist Division, 929 Connecticut Ave., York, Pa.—Folder DH-164 describes a new line of hand hoists, available in capacities from ½ to 4 tons. Complete specifications, action photographs, cross-sectional views and illustrations are listed.
For More Details Circle No. 111—Page 191

CORE TESTING: Claud S. Gordon Co., 3000 South Wallace St., Chicago 16—Four separate catalog sheets deal with a transverse test core maker, transverse core tester, core hardness tester, and a laboratory core baking oven. Descriptive, operation, and specification data are given.
For More Details Circle No. 112—Page 191

ELECTRIC HAMMERS: Syntron Co., 540 Lexington Ave., Homer City, Pa.—Folder describes and illustrates the company's line of electric hammers, drills, and hammer tools. Specifications are included.
For More Details Circle No. 113—Page 191

NODULAR IRON: Cerium Metals Corp., 153 Waverly Pl., New York 14—Booklet gives details of actual practice in adding cerium to the foundry melt, as developed by the British Cast Iron Research Association.
For More Details Circle No. 114—Page 191

HYDRAULIC PRESSES: Denison Engineering Co., 1160 Dublin Rd., Columbus 16, O.—Bulletin 120A describes the company's line of hydraulic presses, press accessories, hydraulic pumps, and fluid motors.
For More Details Circle No. 115—Page 191

CONVEYOR: Jeffrey Mfg. Co., 907 North Fourth St., Columbus 16, O.—Descriptive bulletin 826 deals with the company's mechanical vibrating conveyor.
For More Details Circle No. 116—Page 191

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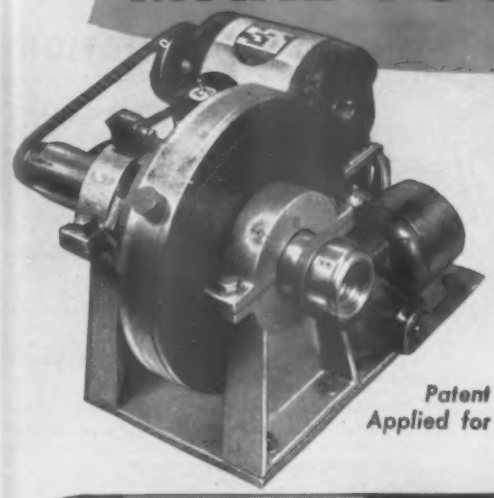

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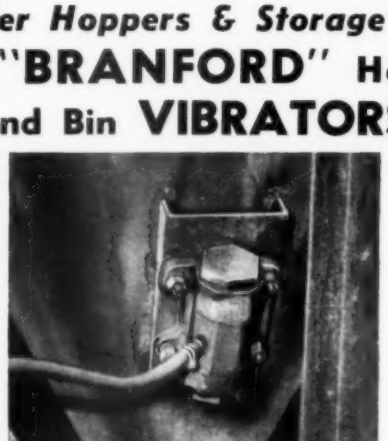

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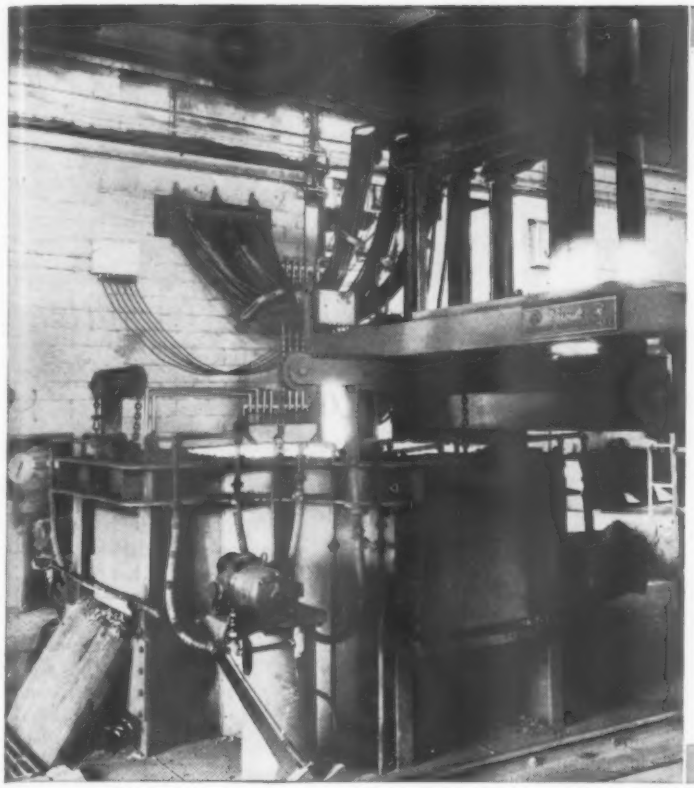

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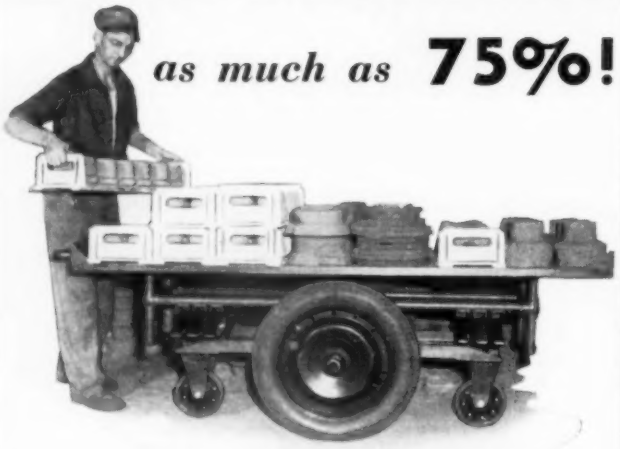

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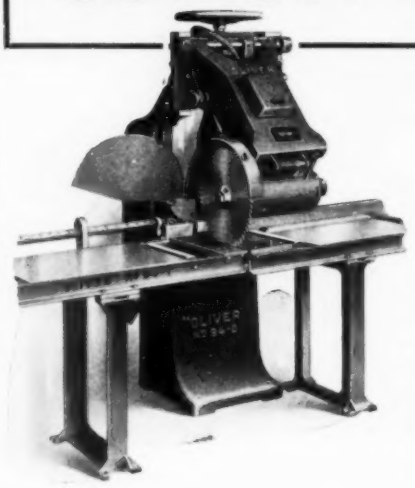

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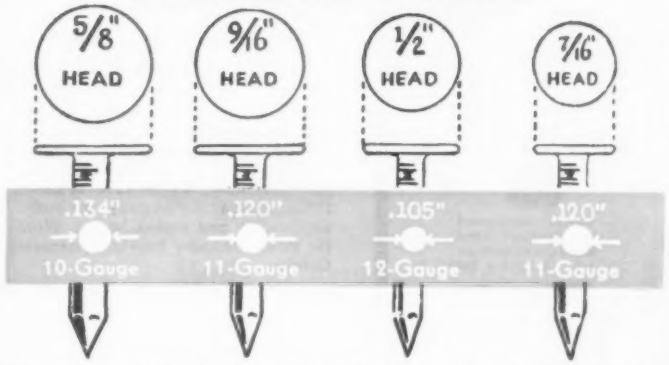

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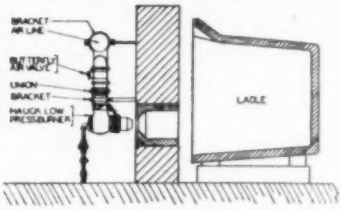

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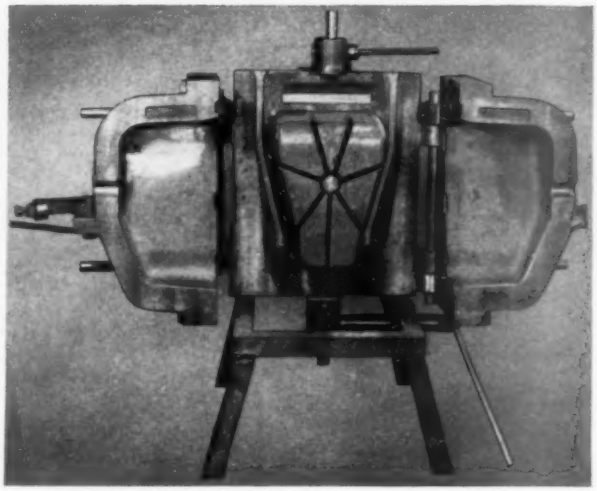

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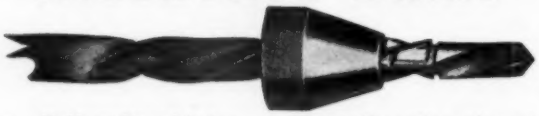

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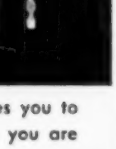

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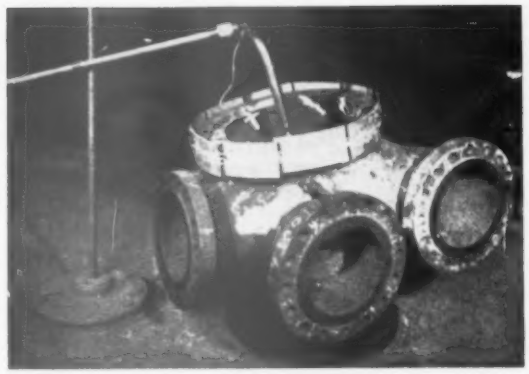

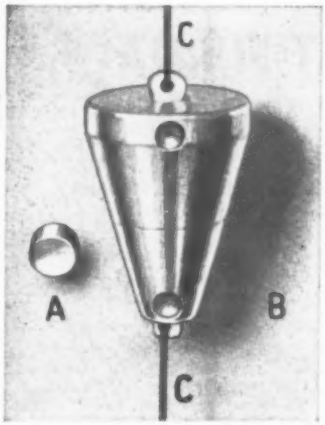

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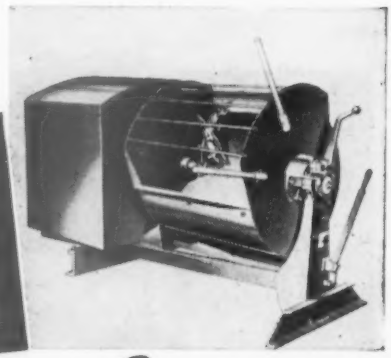

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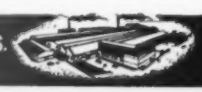

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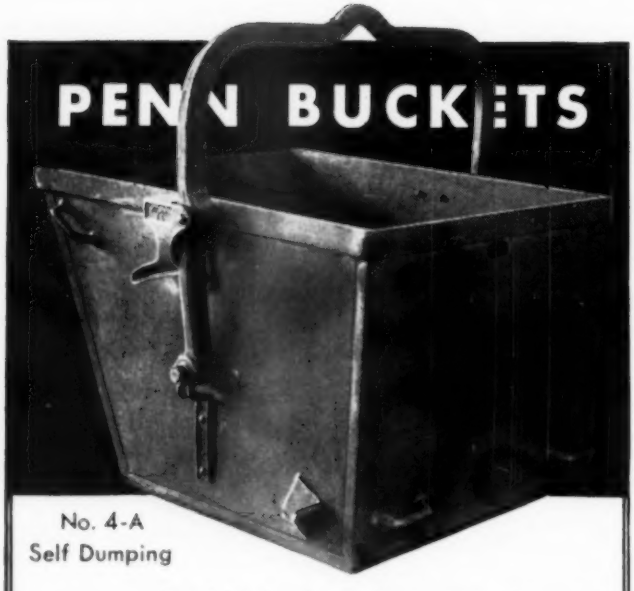

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CHARCOAL

Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

CHARCOAL (Briquets)

Ford Motor Co., Iron Mountain, Mich.

CHEMICALS

Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Hercules Powder Co., Wilmington 99, Del.
Wm. F. Jobbins Co., Aurora, Ill.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.

CHEMISTS

Crobaugh Co., Frank L., 1426 West Third St., Cleveland 13, Ohio.

CHILLS

Alloy Metal Abrasive Co., 311 W. Huron St., Ann Arbor, Mich.
Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland, Ohio.
Fanner Mfg. Co., Brookside Park, Cleveland 2, Ohio.
Milwaukee Chaplet & Mfg. Co., 1023 So. 40th St., Milwaukee 4, Wis.
Standard Horse Nail Corp., New Brighton, Pa.

CHILL COATINGS

Acheson Colloids Corp., Port Huron, Mich.

CHILL NAILS

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland, Ohio.
Capewell Mfg. Co., Hartford, Conn.
Standard Horse Nail Corp., New Brighton, Pa.

CHIPPERS—See PNEUMATIC TOOLS

CHISELS (Chipping)

Arrow Tools, Inc., 1900 S. Kostner, Chicago, Ill.
Cleco Division of Reed Roller Bit Co., Houston, Texas.

CHROMIUM (Briquets)

Electro Metallurgical Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

CLAMPS (Flask)

Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Sterling Wheelbarrow Co., 1700 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CLAMPS (Permanent Mold)

Master Pattern Co., 1315 Main Ave., Cleveland. Ohio.

CLAY (Bonding)

American Colloid Co., Merchandise Mart Plaza, Chicago 54, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin 3, Mo.
Baroid Sales Division, 830 Ducommun St., Los Angeles 12, Calif.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.

CLAY (Refractory)

Carpenter Brothers, Inc., 606 West Wisconsin 3, Mo.
Eastern Clay Products Inc., Jackson, O.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Chas. Taylor Sons Co., P. O. Box 58, Annex Sta. Cincinnati 14, Ohio.

CLAY STORAGE BINS

Neff & Fry, Camden, O.

CLEANING EQUIPMENT (Castings)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.

CLUTCHES (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 622 S. 28th St., Milwaukee 4, Wis.

COAL STORAGE BINS

Neff & Fry, Camden, O.

COKE (Foundry)

DeBardeleben Coal Corp., 2201 First Ave., N., Birmingham 3, Ala.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Inland Steel Co., 38 So. Dearborn St., Chicago 3, Ill.
Pickands, Mather & Co., Cleveland 14, O.
Republic Coal & Coke Co., 8 So. Michigan Ave., Chicago 3, Ill.
Semet-Solvay Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.

COKE (Petroleum)

Republic Coal and Coke Co., 8 S. Michigan Ave., Chicago 3, Ill.

COLLECTORS (Dust)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland, O.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette St., Detroit 2, Mich.
Schneible Co., Claude B., 2827-25th St., Detroit 16, Mich.

CONCRETE STORAGE BINS

Neff & Fry Co., Camden, O.

CONTROL SYSTEMS (Dust)

American Air Filter Co., 223 Central Ave., Louisville, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
Schmieg Industries, 302 Piquette St., Detroit 2, Mich.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

CONVERTER BLOWERS

Roots-Connersville Blower Corp., Connersville, Ind.

CONVERTERS (Bessemer)

Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

CONVEYOR DESIGN

Frank D. Campbell, 332 So. Michigan Ave., Chicago, Ill.
Giffels & Valet, Inc., Marquette Bldg., Detroit, Mich.
Palmer-Bee Co., Westminster & G.T.R.R., Detroit 12, Mich.

CONVEYORS (Apron)

Logan Co., 580 Cabel, Louisville, Ky.

CONVEYORS (Belt)

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, O.
Imperial Belting Co., 1800 So. Kilbourn Ave., Chicago 23, Ill.
Jerffey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Chain)

Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Palmer-Bee Co., Westminster & G.T.R.R., Detroit 12, Mich.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Gravity)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Live Roller)

Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Standard Conveyor Co., North St. Paul 9, Minn.
Palmer-Bee Co., Westminster & G.T.R.R., Detroit 12, Mich.

CONVEYORS (Magnetic)

Stearns Magnetic Mfg. Co. 662 S. 28th St., Milwaukee 4, Wis.

CONVEYORS (Monorail)

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 E. 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., 104 Tenth St., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Penn Iron Works, Reading, Pa.

CONVEYORS (Overhead)

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Palmer-Bee Co., Westminster & G.T.R.R., Detroit 12, Mich.

CONVEYORS (Pneumatic)

Fuller Company, Catasauqua, Pa.

CONVEYORS (Portable)

Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Portable-Gas Electric)

Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

CONVEYORS (Rubber)

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Standard Conveyor Co., North St. Paul 9, Minn.

CONVEYORS (Vibrating)

Ajax Flexible Coupling Co., Westfield, N. Y.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.
Simplicity Engineering Co., Durand, Mich.
Syntron Company, Homer City, Pa.

COPPER

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

COPPER SHOT

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

CORE BINDERS

American Gum Products Co., 500 Fifth Ave., New York 18, N. Y.

CORE BINDERS (Cont'd.)

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave., New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
General Electric Co., Pittsfield, Mass.
Hercules Powder Co., Wilmington 99, Del.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Chas. A. Krause Milling Co., 404 E. State St., Milwaukee 1, Wis.
Robeson Process Co., 500 Fifth Ave., New York 18, N. Y.
Superior Flake Graphite Co., 33 So. Clark St., Chicago 3, Ill.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Velsicol Corp., 330 E. Grand Ave., Chicago 11, Ill.

CORE BLOWER BUSHINGS

Eastern Clay Products, Inc., Jackson, Ohio.

CORE BLOWING MACHINES

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Molding Machine Co., LaGrange Park, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Western Hardware & Specialty Mfg. Co., 3830 No. Fratney, Milwaukee, Wis.

CORE BOXES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio.

CORE COLORING

Eaton Chemical & Dyestuff Co. 1490 Franklin, Detroit, Mich.

CORE COMPOUND

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Bakelite Corp., 300 Madison Ave., New York 17, N. Y.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.
Velsicol Corp., 330 E. Grand Ave., Chicago 11, Ill.

CORE DRAWING MACHINES

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., Toledo 5, O.
Newaygo Engineering Co., Newaygo, Mich.

CORE DRIERS (Dielectric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

CORE GRINDERS (Power Operated)

Jeffrey Mfg. Co., Columbus 16, O.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.

CORE KNOCKOUT MACHINES

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Pangborn Corp., Hagerstown, Md.
Simplicity Engineering Co., Durand, Mich.

CORE MAKING MACHINES

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Wm. Demmler & Bros., Kewanee, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Redford Iron & Equipment Co., 20733 Glendale Ave., Detroit 23, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

CORE OILS

Archer-Daniels-Midland Co., Werner G. Smith Div., 2191 W. 110th St., Cleveland 2, O.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Frederic B. Stevens, Inc., Detroit 26, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
Velsicol Corp., 330 E. Grand Ave., Chicago 11, Ill.

CORE OVENS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, O.
Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Girdler Corp., Thermex Division, 224 E. Broadway, Louisville 2, Ky.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Ross Engineering Corp., J. O., 350 Madison Ave., New York 17, N.Y.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PASTE

Corn Products Sales Co., 17 Battery Pl., New York 4, N. Y.
Delta Oil Products Co., Milwaukee 9, Wis.
Eastern Clay Products Co. Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

CORE PLATES (Steel, Asbestos)

Black, Sivalls & Bryson, Inc., 720 Delaware, Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Johns-Manville, 22 E. 40th St., New York 16, N. Y.
Pressure Match Plate Co., 1013 N. Front St., Philadelphia 23, Pa.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

CORE ROD STRAIGHTENING and CUTTING MACHINERY

American Wheelabrator & Equipment Co., Mishawaka, Ind.

CORE SAND

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Weldron Silica Co., 38 So. Dearborn St., Chicago, Ill.

CORE SAND MIXERS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

CORE STRIPPERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE TRAYS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

CORE TRUCKS

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Kirk & Blum Mfg. Co., Cincinnati 25, O.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

CORE VENTS

Demmler, Wm., & Bros., Kewanee, Ill.
Smillie, C. M. & Co., 1124 Woodward Heights Blvd., Ferndale 20, Mich.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

CORE WASH

Asbury Graphite Mills, Asbury, N. J.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Carborundum Co., Perth Amboy, N. J.
Cities Service Oil Co., 3200 S. Western Ave., Chicago 8, Ill
Corn Products Sales Co., 17 Battery Pl., New York City 4.
Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Stevens, Frederic B., Inc., Detroit 26, Mich.
United Oil Mfg. Co., 1429 Walnut St., Erie, Pa.
United States Graphite Co., Saginaw, Mich.

CORE WIRE CUTTERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRE STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

CORE WIRES

Crescent Brass & Pin Co. 5766 Trumbull Ave., Detroit, Mich.

CORES (Annealing)

Pressed Steel Co., Wilkes-Barre, Pa.

CORES (Ceramic)

American Lava Corp., Chattanooga, Tenn.

COUPLINGS (Air Line)

Cleco Division of Reed Roller Bit Co., Houston, Texas.
U. S. Air Compressor Co., 5300 Harvard Ave., Cleveland 5, Ohio.

COUPLINGS (Flexible)

Ajax Flexible Coupling Co., Westfield, N. Y.

CRANE LUBRICATING SYSTEMS

Blaw-Knox Co., Farmers Bank Bldg., Pittsburgh, Pa.

CRANES (Bucket)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Electric Tramrail)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

CRANES (Electric Traveling)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Erie Steel Construction Co., Erie, Pa.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Gantry)

Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Wellman Engineering Co., 7000 Central Ave., Cleveland 4, O.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Hand Traveling)

American MonoRail Co., 12104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Jib)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CRANES (Monorail)

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.

CRANES (Self-Propelled)

Silent Hoist & Crane Co., 335 63rd St., Brooklyn 20, N. Y.

CRANES (Traction or Tractor)

Silent Hoist & Crane Co., 885 63rd St., Brooklyn 20, N. Y.

CRUCIBLES

American Crucible Co., North Haven, Conn.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.
Lava Crucible Co., Pittsburgh, Pa.
National Crucible Co., Mermaid Lane and Queen Sts., Philadelphia 18, Pa.
Ross-Tacony Crucible Co., Tacony, Philadelphia, Pa.
Vesuvius Crucible Co., Swissvale, Pa.

CRUCIBLE FURNACES

Ajax Electrothermic Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

CRUCIBLE LIFTERS

Modern Equipment Co., Port Washington, Wis.

CRUCIBLE POURING DEVICES

Modern Equipment Co., Port Washington, Wis.

CRUSHERS (Core)

Simplicity Engineering Co., Durand, Mich.

CUPOLAS

Modern Equipment Co., Port Washington, Wis.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Lamson Co., Syracuse 1, N. Y.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CHARGING MACHINES

American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUPOLA CONTROL EQUIPMENT

Foxboro Company, Foxboro, Mass.

CUPOLA DUST ARRESTORS

Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.

CUPOLA HOT BLAST EQUIPMENT

J. O. Ross Engineering Corp., 350 Madison Ave., New York 17, N. Y.

CUPOLA LININGS

Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
United States Graphite Co., Saginaw, Mich.

CUPOLA PATCHING GUNS

Eastern Clay Products, Inc., Jackson, Ohio.

CUPOLA SPARK ARRESTORS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

CUTOFF CORES

American Lava Corp., Chattanooga, Tenn.

CUTOFF MACHINES (Abrasive)

Fox Grinders Inc., Oliver Bldg., Pittsburgh, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

CYLINDERS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

DARK ROOM ACCESSORIES (X-Ray)

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

DARK ROOM PROCESSING (Chemical Tanks, etc.)

Eastman Kodak Co., Rochester, N. Y.

DEGASIFIERS

Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

DEOXIDIZERS

Ajax Metal Co., 46 Richmond St., Philadelphia 23, Pa.
Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5, N.Y.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Metalloy Corp., Rand Tower, Minneapolis 2, Minn.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.

DEOXIDIZERS (Ferrous)

Carborundum Co., Perth Amboy, N. J.

DESULPHURIZERS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hercules Powder Co., Wilmington 99, Del.
Mathieson Chemical Corp., 60 Mathieson Bldg., Baltimore 3, Md.
Modern Equipment Co., Port Washington, Wis.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Solvay Sales Division Allied Chemical & Dye Corp, 40 Rector St., New York 6, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

DIE CASTING MACHINES

Kux Machine Co., 3930 W. Harrison St., Chicago 24, Ill.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.
Miller-Taylor Tool Co., 5005 Euclid Ave., Cleveland 3, Ohio.

DIES

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

DIRECT FIRED HEATERS

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

DOWEL PINS

Standard Horse Nail Corp., New Brighton, Pa.

DRILLS (Pneumatic)

Gardner-Denver Co., Quincy, Ill.
Schramm Inc., West Chester, Pa.

DRIVES (Reciprocating)

Ajax Flexible Coupling Co., Westfield, N. Y.

DRUMS (Magnetic)

Dings Magnetic Separator Co. 4740 Electric Ave., Milwaukee 7. Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

DRYING OVENS

Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

DUMP HOPPERS

Roura Iron Works, 1405 Woodland Ave., Detroit 11, Mich.

DUMP TRUCKS

Frank G. Hough Co., Libertyville, Ill.
Kwix-Mix Co., Port Washington, Wis.
Prime Mover Co., Muscatine, Iowa

DUST ARRESTING EQUIPMENT

American Air Filter Co., Inc., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Kirk & Blum Mfg. Co., Cincinnati 25, O.

DUST ARRESTING EQUIPMENT (Cont'd.)

Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.
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ATLANTA, GEORGIA

For Sale

MAGNETIC SEPARATOR

1—Model 5-14-46 tote all scrap saver powered by 2HP-3PH-60 cycle-220 volt geared head motor.

LADLES

2—Taper covered ladles with model C gearing—"V" type bail M289-#C48043

WOODRUFF & EDWARDS, INC.
119 N. STATE ST. ELGIN, ILLINOIS

FOR SALE

One Whiting cylindrical pouring ladle with E-Z pour tipping mechanism and shifting cover. Ladle is 28 inches in diameter by 32 inches long, with 1550 lbs. capacity.

FERRO MACHINE & FOUNDRY INC.
3155 EAST 66TH ST. CLEVELAND 27, OHIO
PHONE: MICHIGAN 1-1000

FOR SALE

2", 3", 4" drop pattern soil pipe machines, core machines, arbors, flasks, core knives, etc. We will manufacture any quantity desired.

BOX 962
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

#4 Whiting cupola, Whiting elevator, Sly sandblast room, type F magnesium furnaces, Lanly normalizing oven, saw-filing machine, miscellaneous foundry equipment. Address:

RIDGE CASTING DIVISION
MINERAL RIDGE, OHIO

FOR SALE

1—Pangborn 9' diameter "LG-14" practically new, Multi-table rotoblast machine, complete including all motors, etc.

1—Dust collecting system

1—Lot spare parts

10—tons No. C-120 metallic grit used in this equipment.

THE UDYLITE CORPORATION
2501 E. GRAND BLVD., DETROIT 11, MICH.
C. A. SHAFER, DIRECTOR OF PURCHASES

FOR SALE

2 Cupolas 63" shells complete with charger, blower, and Foxboro controls
1 Ingersoll-Rand Air Compressor, 1-XORB, 50 H.P.
1 Simplicity Shakeout 4' x 8' practically new
50 sizes of Hines Flasks and Jackets, some new
1 Wet Dust Collector
Cleveland Tramrail cranes and runways, also electric and air hoists
1 #10 S4W Marley induced draft cooling tower complete with 5 H.P. pump
Conveyor belts, new—width 24"-20"-15½"-11"
6 Cylindrical pouring ladles—modern 300# & 500# capacity
3 SPO, model 211B, jolt squeeze pin lift, serial #151-152-153
2 Milwaukee, jolt squeeze swing head, model 123-10—serial No. 12948
3 SPO, model 2114G, jolt squeeze pin lift, 11" cylinder serial 163-4-5
1 International, Model 255, hand roll over core making machine
1 Demmler #55 Core Blower Machine.
50 each size—10 x 20 7/7 & 15 x 18 6/6 New Sterling flasks

THE BARDES FORGE & FOUNDRY COMPANY
2619 COLERAIN AVE.
CINCINNATI 14, OHIO
TELEPHONE—KIRBY 4224

For Sale

FOR SALE

MOLDING MACHINES
1—74W Osborn Plain Squeeze Portable
2—75W Osborn Plain Squeeze Portable
3—75J Osborn Jolt Squeeze Portable
3—Federal RAPID Jolt Squeeze Portable
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers
1—SPO #4½ JHS Air Jolt Hand Strip
BLOWERS FOR CUPOLAS AND FURNACES
1—40 H.P. Spencer-Turbine 5100 CFM 18-oz. pressure
1—Piqua Rotary Pressure Blower, rated 19 cu ft per Rev.
Maxon-Premix Blowers for Gas, ¼ to 1 H.P.
METAL MELTING EQUIPMENT
1—Stationary crucible aluminum furnace, gas fired, 400# cap. complete with blower and motor
1—Hausfeld 2000# Aluminum Capacity Furnace, Barrel Type, open flame, oil fired
2—Monarch-Rockwell Rotating 500# Brass, Oil
New 32" to 41" Dia. shell Cupolas made to order
TUMBLING MILLS AND SAND BLAST
5—28 x 60" round exhaust mills
1—Pangborn No. 2 GH direct pressure type sandblast barrel, motor driven. Complete Unit
1—Pangborn Sand Blast Unit, including generating tank, shot cleaner, bucket elevator. Suitable for use with room
1—Pangborn Type EN-2 Sand Blast Cabinet, suction type, 5 x 3 x 7' high
MISCELLANEOUS
1—Sprue cutter motor drive, 1½ x ¾ knives
1—Rotoplane speed sifter
7—Crane ladles, worm gear tilt, 1000 to 14,000# capacity
1—Continuous Heat Treat Furnace 57' long 1200° F. Max.
5—Koch electrically heated ovens for baking cores, 4½ ft. wide, 6 ft. high, 6 ft. deep, complete with recirculating fan and controls
1—Young Bros. Tower Core Oven, 5 ft. x 1 ft. shelves, gas fired, complete with Foxboro control
1—Young Bros. Batch Type Recirculating Hot Air, gas fired, Core Oven, 5 ft. x 6 ft. door opening, 9 ft deep
3—Foundry Equipment Co. sliding shelf core ovens with five 30 x 42" shelves, 8" high, gas fired
1—Lamson Endless Mold Conveyor, 100 ft. long x 16 ft. wide, with 19 x 26" pallets, 36" on centers
1—Bucket Sand Elevator, 50 ft. tall, complete
4—Heavy Duty Flexible Shaft Grinders 2 H.P.
Ingersoll-Rand air hoists, 2, 3, 5 ton cap.

CLIFTON MACHINERY CO.
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

Air-jolt-clamp-leveler-rollover pattern draw molding machine. 44" x 54" table—18" pattern draw 2000 lb capacity—condition like new. Price.... ⅓ of new cost. American Wheelabrators tumblast, 20 x 27, 27 x 36, 48 x 48.

BALCHER MACHINERY COMPANY
1884 S. COMPTON ROAD
CLEVELAND HEIGHTS 18, OHIO
TELEPHONE: FA 1-1186

FOR SALE

One Herman rollover moulding machine, late model, in excellent condition, size 40 x 58" 3740 pounds rollover capacity. Equipped with air clamps. Offered at bargain price. Address: Box 861, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

American model M Sandcutter 89/70 cost new June, 1947 $7,226.00. Perfect condition. 3 phase—60 cycle—220 volts. Price $3,000.00. Address: WERNER FOUNDRY, INC., LANSDALE, PA.

EQUIPMENT FOR SALE

Sand cutters
Transite core plates
Swing Frame Grinder
10 ton bottom pour ladle
2—Rotocast machines
1—Modern equipment U type reservoir ladle 2500 lb.
Molding machines, etc.
Send for our latest list #11

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 EAST BROAD STREET
SHILLINGTON, READING, PA.
PHONE 3-0311—4-0146

Classified Advertising

For Sale

FOR SALE
FOUNDRY EQUIPMENT

1—Ruemelin Sand Blast Cabinet.
Size: 48" x 30" x 36" high, Type: AL, Complete with 18" rotary table, 1½ HP 220/440 volt — 50/60 cycle 2875/3450 RPM—Diehl Electric Motor and Pangborn Blower.
Condition: Good.

2—Fischer Gas Fired Tilting Furnaces.
Type: MNP, Size 1,000 lbs, complete with 1 pouring spout and stand each, 1 Fischer J-50 blower and electric motor each, atmospheric regulators.
Condition: Fair.

4—Fischer Aluminum Holding Furnaces.
Type: ADC Series #2, Size: 550, Gas Fired, Lined with mulite, complete with 1 Fischer J-50 blower and electric motor, regulators.
Condition: Good.

1—Eclipse #8 AL Aluminum Melting Furnace.
Gas Fired, 400 lb. Capacity.
Condition: Good.

6—Brown Continuous Indicating Potentiometers.
Type: 156C16P-20, Range: 0-1600° F.
Condition: Good.

4—Hydraulic Molding Machines.
Complete with—2 hydraulic pumps & 5 HP Electric Motors, 2 automatic and manual control panels.
Condition: Good.

1—Casting Conveyor.
Consisting of: 4-10′ sections belt conveyor track, stands for track, power section—1 HP elec. motor and 1200 RPM—96 ratio speed reducer, wire mesh conveyor belt.
Condition: Fair.

FINISHING EQUIPMENT

2—Roto Clone Air Filters.
Type: D, Size: #10, Complete with 3 HP—3 Phase—60 cycle 220/440 volt Electric Motor, Blowers, Air Filter Chambers.
Condition: Good.

1—Roto Clone Air Filter Blower & Motor.
Type: D, Size: 10, Roto Clone Air Filter, 3 HP, 3 phase, 60 cycle—220/440 volt electric motor, blower.
Condition: Good.

2—Standard Double End Polishing Lathes.
Type: 5 RSB-3, Model: 101 Spindle RPM—220-2400-2700. Complete with 1 (each 5 HP—220 volt—60 cycle—3 phase) G.E. motors.
Condition: Good.

1—Standard Double End Polishing Lathe.
Type: RSBY, Complete with 5 HP—220 volt—3 phase—60 cycle G.E. Motor.
Condition: Good.

3—Do-All Dust Collectors.
Complete with: ¼ HP 440 volt electric motors.
Condition: Good.

5—Mattison #400 Backstand Idlers.
Condition: Good.

1—Hammond #3 Model 3A Backstand.
Condition: Good.

2—Rotor Clone Air Filters.
Size: 2½, Type: N, Complete with: 1—7½ HP electric motor and blower each.
Condition: Good.

4—Roto Clone Air Filters.
Size: 1½, Type: N, Complete with 1—5 HP electric motor and blower each.
Condition: Good.

1—Roto Clone Air Filter.
Size: 4, Type: N, Complete with 15 HP electric motor and blower.
Condition: Good.

1—Wheelabrator.
Model: BM-75300, Electrically equipped for 3 phase—440 volt. Accommodate any size grit, complete with vented hubwheel, blasts for WA Table, 5-17" dia. tables, 1—10 HP Louis Allis Electric Motor.
Condition: Good.

1—Wheelabrator Dust Collector.
Complete with 3 HP General Electric Motor, Type C No. 9 Blower.
Condition: New.

3—Sun Ray Polishing Machine for polishing inside of cooking utensils.
TNA 5106, 2 complete with 2—3 HP electric motors and 1 belt sanding head each, 1 complete with 1—3 HP motor and 1 5 HP motor and 1 polishing head. 1 extra belt type sanding head and ¾ HP electric motor.

1—Cadillac Stamping Hydraulic Marking Machine.
Complete with 3 HP—220/440 volt 3 phase 60 cycle Louis Allis Electric Motor.
Condition: Good.

GENERAL MILLS, INC.
1620 CENTRAL AVE.
MINNEAPOLIS 13, MINN.
Phone GRanville 8811 **W. H. Schmitt, Pur. Agt.**

FOR SALE

A reasonable offer will get you a modern sand handling system consisting of 19 individual moulders' hoppers, two 25-ton sand storage bins, one #50 Beardsley & Piper speed muller with 40 HP Motor, magnetic separator with bucket elevator, overhead monorail system and cab controlled electric hoist and monotractor and shell buckets with automatic trips for delivering sand from speed muller to moulders' hoppers.

OLD COLONY FOUNDRY COMPANY
EAST BRIDGEWATER MASSACHUSETTS

FOR SALE
RUBBER BELTING

710 ft. piece 20" x 4 ply, 28 oz. duck 1/32" x 1/8" cover, brand new—never used—U. S. Rubber Co. Security brand, $2.60 lineal ft. or will trade for 24" belt. Address: Box 969, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE
Chisel Blanks-Chisels

You can save on these while they last. Offered subject to prior sale.

6000—¾ x 8 Hexagon Shank Blanks "Steel Conversion" 1600 water 400 draw. 60c each $50.00 per 100
2000—¾ x 8 Differential Shank Blanks 50c each $45.00 per 100
600—¾ x 9 Hexagon Shank Diamond Point Chisels "Delaware C" 75c each $70.00 per 100
700—¾ x 9 Hexagon Shank 1/16" Cape Chisels "Delaware C" 75c each $70.00 per 100

BEATTY ELECTRIC TOOLS
8186 LIVERNOIS AVE. DETROIT 4, MICH.

EQUIPMENT FOR SALE

13′ Beardsley & Piper tractor-type sand slinger with magnetic separator tower; sand leveling device; 16" x 4" x 20 HP head; arms: 6′-0" & 4′-0"; turning device; 220 volt, 3-phase, 60 cycle; serial No. T-178. Installed new during 1946 and used one shift for 5-6 months. Condition: Excellent-like new. Address: Box 955, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

1—Hausfeld aluminum melting furnace, style 900-GT, gear tilting type, lined with firebrick and insulated. One F-550 cast iron pot for natural gas with a #8-A Hausfeld premixing type blower. Direct connected ½ HP 220 volt, 60 cycle, 3 phase motor. Brand new; never taken from crate. Cost $854.13. Will take $775.00. Address: MEMPHIS CASTING WORKS, INC., P.O. BOX 1622, MEMPHIS, TENNESSEE.

FOR SALE

1—Whiting Cupola #6-50 foot stack. Dismantled and in excellent condition.
1—Lindberg Pit Type Tempering Furnace—Type 2828-EH Serial #1337.
1—American Wheelabrator Multi Tablast Model BM-66200, Serial #A50689.
2—Tannewitz Bandsaws with 36" wheels and one with 42" wheel—excellent condition.
2—Double End Pedestal Grinders.
1—Royer Shakeout Machine.
8—Tabor Stationary Jar Top Squeezers.
1—Tabor Portable Jar Flask Lift Moulding Machines—20" x 24" table.

OLD COLONY FOUNDRY COMPANY
EAST BRIDGEWATER MASSACHUSETTS

For Sale

STEEL FLASKS—FOR SALE

We have recently purchased a complete inventory of flasks (mostly Sterling) in sizes from 10" x 26" to 50" x 60" and round flasks from 18" to 24" in diameter. These flasks are in very good condition and were in use until foundry operations of a large Massachusetts manufacturer were discontinued. To move this large stock of about 3500 flasks, we are offering all or any quantity thereof at very reasonable prices. For further details, address: Box 958, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

1 Cupola Model B #6-66 Shell with Blower and Fox Boro Controls.
Air Compressors: 1 Chicago Pneumatic 9 x 9, 30 H.P. motor, 1 Gardner 9 x 8, 35 H.P. motor
Core Blowers: 2 International, 6 Redford Bench.
17 Milwaukee Jolt Squeezers.
Screenerators: 1-sm. 1-med. 1-lg., 440 V. motors 3 phase. 1 Royer.
3 Tumblers, V Belt Drives.
2 Cincinnati Stand Grinders.
Ross Core Drawers, Bench and Stand.
Write for price, or Call /G-L 67567.

IDEAL FOUNDRY CO.
321-329 SUMMER AVE.
GRAND RAPIDS, MICH.

FOR SALE

TURBO BLOWERS (3 Phase, 60 Cycle)

cfm	Pressure	Make	Motor H.P.	Volts	Speed
3500	40 oz.	Spencer	60	440	1800
2200	40 oz.	Spencer	40	220/440	3600
1400	16 oz.	Spencer	220/440	3/60	3600
225	10	Spencer	1	220/440	3600

PRESSURE BLOWERS (3 Phase, 60 Cycle)

2500	7 oz.	Sturtevant	15	220/440	1800
2400	14 oz.	Mahr	15	220/440	3480
1300	16 oz.	Nth.Amer.	10	440	1800
1150	20 oz.	Nth.Amer.	10	220/440	3600
950	16 oz.	Nth.Amer.			
800	8 oz.	Sturtevant	7½	220/440	3600
800	24 oz.	American	10	220	3600
450	6 lbs.	A&B	30	220/440	3450
150	12 oz.	Nth.Amer.	1	220	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

FOR SALE

145—Sterling Steel Flasks—1 Pin on each side—12 x 18, 3 Cope & 3 Drag.
119—Truscon Steel Flasks—1 Pin on each side—12 x 18, 3 Cope & 3 Drag.
These Steel Flasks are practically new.
2—Tabor, Air Jolt, Rollover Machines 14 x 16 Table.
1—Pouring Device.
1—Globe Tilting Water Tumbler.
1—American Sand Cutter, Gasoline Driven.
1—Johnston & Jennings 24 x 30 Rollover.
1—Tabor 30 x 40 Rollover Machine.
1—27 x 36 Wheelabrator.
1—#9 Whiting Cupola complete with Motor, Blower, and Blast Regulator.
10—"G" Power Rollover Machines.
15—Jolt Squeezers of most any make.
1—Automatic lift truck with charger.
1—50" Moulder's Friend Sand Cutter with 15 HP Motor.
1—Grinding Wheel Stand 3 x 24" Wheels.
1—Marshke Swing Grinder with 5 HP Motor.
1—Stearns Magnetic Pulley, New. Serial #20442, 125 volts, RPM 40. Manufactured by Stearns Magnetic Mfg. Co., Milwaukee, Wisconsin.
1—Motor Generator Model #498 Induction motor generator set ¾ KW diverter pole generator, 125 volts @ 6 amp DC with 1½ HP 220/440/60/30 Across the line motor. New.
Osborn 558 and 559 Jolt Strippers.
Belting, New, 187 Ft. Ajax 20" 5 Ply 28 oz. conveyor belting with ⅛" top and 1/32" bottom cover.
J.D.P. International Jolt Strippers.

HAYNES FOUNDRY EQUIPMENT CO.
814 ADA ST. KALAMAZOO 52, MICH.

Classified Advertising

For Sale

MAGNESIUM FOUNDRY EQUIPMENT

MOLDING MACHINES

5 "Grimes", mod. C-216 rollover
7 "Grimes", mod. C-414 rollover
2 "Johnston & Jennings", mod. 610 air draw type
5 "Osborn", mod. 275J jolt squeeze
2 "Osborn", mod. 405 jolt rollover
1 "Osborn", mod. 405-77 jolt rollover, pattern draw
2 "Osborn", mod. 560-20 jolt stripper
4 "Osborn", mod. 602 jolt rollover
1 "Davenport", mod. 40AJS jolt stripper
1 "Tabor", 10" special shockless, jar squeezer
2 "Tabor", split pattern jolt squeeze. Patt. size 13" x 18'

CORE MACHINES

1 "Tabor" pedestal type rollover
1 Demmler" core blower #2

FURNACES & OVENS

9 "Hausfeld", 100# cap. pot type melting—oil fired
20 "Hausfeld", 200# cap. pot type melting—oil fired
4 "Hausfeld", 400# cap. pot type melting—oil fired
4 "Hausfeld", 1000# cap. tilting type melting—oil fired
6 "Hausfeld", 1200# cap. tilting type melting—oil fired
4 "G.E." elec. heat treat elevator type, basket size 60" W x 72" x 60" H
1 "Gehnrich", 1, compt. preheating—gas fired

SAND MIXERS

1 "Simpson" #2 sand mixer
4 "Simpson" #1½ sand mixers

MISCELLANEOUS EQUIPMENT

1 "Kane & Roach" #5DX wire straightener
1 Shakeout "Simplicity", mod. "B", 4' x 6' with 5 hp mtr.
5 Jib cranes with 2 ton air hoists
1 Dust collector, "Schmeig" Centri-Merge #112S, 1000 CFM with 3 hp mtr.

BOHN ALUMINUM & BRASS CORP.
1400 LAFAYETTE BLDG. DETROIT 26, MICH.

REBUILT EQUIPMENT

1—#7 Whiting Cupola with Blower & Skip Hoist
1—Stationary Sand Slinger, single belt
1—Lot Ladles—3-5-10 & 15 ton
1—American Rod Straightener with gagger attachment

International Molding Machines, portable type G, 20" & 24"
1—#1 Simpson Mixer
1—#40 Speedmullor
1—Osborn Core Blower #193
1—27 x 36 Wheelabrator (Rebuilt)

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO., NOT INC.
767 MILWAUKEE AVE. CHICAGO 22, ILL.
PHONE: CANAL 6-0314

SAND BLAST EQUIPMENT

Pangborn 2S GK2 Rotoblast Barrel, complete with Loader and $4,000.00 spare parts. A-1-Condition.—$5,000.00.
Pangborn 7GK2 Rotoblast Barrel with Loader, used very little.—$3,950.00.
Pangborn Direct Pressure Tank, Model AQ1. Excellent condition.—$575.00.
Pangborn 6 ft. table without motors—$800.00.
Wheelabrator No. 2 Tablast. Good condition—$3,000.00
Sly Sand Blast Double Room, 8 x 8, 30% of list price.
Sand Blast Cabinets and Dust Collectors, all kinds and sizes, like new. 40% of list price.
If you are interested in savings of 25% to 70% on your Sand Blast replacement parts (Wheelabrator, Pangborn, etc.) write immediately, stating type, size of your Sand Blast Machine (Tumblast, Tablast, etc.) and we will mail listing of parts available for your equipment.

DIAMOND SANDBLAST CO.
5654 W. JEFFERSON AVE.
DETROIT 9, MICHIGAN

For Sale

FOR SALE

1 Moulders Friend Sand Cutter, 48 inch, Model 1946. Good condition
1 Economy Double End 10 HP Grinder, 20 x 2½ x 2 wheels

THE MAJESTIC COMPANY
HUNTINGTON, INDIANA

FOR SALE

By Northeastern Ohio Foundry

1—Herman Pneumatic 10,000 pound Independent turnover and pattern drawing device, cylinder type equalizer with outboard bearings and 2 turnover plates, 66" x 72".

BOX 992
THE FOUNDRY CLEVELAND 13, OHIO

PRICED FOR QUICK SALE

2 NEW BARRETT TYPE CUPOLAS, 26" inside diameter, complete with blower. Capacity 2500 lbs. per hour each. Designed for platform loading and suitable for ferrous or nonferrous metals. These were erected but never used.

RANDALL GRAPHITE BEARINGS INC.
LIMA, OHIO

FOR SALE

12 CLECO FLOOR RAMMERS, Size 4, New Condition—$47.50 each
12 CLECO BENCH RAMMERS, Size 4, New Condition—$45.00 each
ELECTRIC VIBRATORS, NEW, Adjustable for light, medium and heavy match plate work—$10.00 each
1—48 x 72 AMERICAN WHELABRATOR WITH LOADER
Information and price on application.
All prices F.O.B. Minneapolis, Minn.

E. R. FROST CO., INC.
1179—15th AVE. S.E.
MINNEAPOLIS 14, MINN.

FOR SALE
FOUNDRY EQUIPMENT

1—B-P 13 ft. tractor Sandslinger with sand leveler and jib cranes, complete.

3—32-ft. span electric cranes and hoists to service above Sandslinger.

1—American Wheelabrator Model AA Sandcutter Size 108/73 Latest model, fully equipped.

4—Hammond double end sand grinding stands 2—5 HP, 2—7½ HP heavy duty type, 440/3/60, controls.

1—Gardner horizontal surface grinder, Model 124, 52" dia. motor and controls.

2—Modern Equipment Co. No. 7 cupolas arranged for skip hoist charging, complete with Spencer turbo-blower & Foxboro control, and Modern swivel skip hoist charger with 2000 lb. bucket, scale and weigh hopper. Sold as unit. 3000 lb. mixing ladle optional.

1—Whiting O.E.T. Crane 60 ft. span 40 ft. hoist. Outdoor type for cupola service. 440/3/60 electric 42" EC&M magnet and ¾ yd. Blaw Knox single line clam bucket available. Crane has m.g. set and magnet reel.

2—1500 lb. Modern Equipment Co. straight side covered and insulated geared ladles.

2—2000 lb. Modern Equipment Co. straight side covered and insulated geared ladles.

1—Parsons cloth tube Dust Arrestor Type SF No. 138, 16,500 CFM fan and motor complete.

1—AAF No. 16D Rotoclone complete with 15 HP motor and dust hopper.

1—Mortar mixer for fire clay. CM Co No 6 with 5 HP motor.

THE WILLIAMSON HEATER COMPANY
CINCINNATI 9, OHIO

For Sale

FOR SALE

Two Used 48 Inch
Knapp Tilting Kettles
With pressure regulator & blower
Lead capacity 9,400 lbs.
Zinc capacity 5,800 lbs.
Both in excellent cond.

NEWMAN
IRON & METAL CO.
1740 E. SLAUSON AVE. L. A. 58, CALIF.
JEFFERSON 2226

ATTENTION MANUFACTURERS AGENTS!

Please register with The FOUNDRY stating what type of foundry equipment, supplies or accessories you now handle or would like to handle in the future.

We have many requests for the names of Manufacturers Agents and might be able to refer you to new accounts or to buyers looking for local representatives for various types of foundry equipment.

Write us today and be included in our new list of supply houses and manufacturers agents.

THE FOUNDRY
831 PENTON BLDG. CLEVELAND 13, OHIO

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY BRINGS RESULTS!

IF YOU ARE SEEKING A CHANGE OF POSITION TO BETTER YOUR SITUATION AND ARE QUALIFIED FOR A BETTER JOB, TELL THE 35,000 READERS OF THE FOUNDRY ABOUT IT.

DON'T "HIDE YOUR LIGHT UNDER A BUSHEL"—THERE ARE TIMES WHEN A MAN SHOULD TALK ABOUT HIMSELF AND THERE ARE A LOT OF MEN QUALIFIED FOR BETTER POSITIONS WHO DO NOT KNOW HOW TO GO ABOUT IT OR WHERE TO SEEK HIGHER RESPONSIBILITIES.

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY WILL BE WIDELY READ AND THE RESULTS MAY SURPRISE YOU!

IT COSTS BUT LITTLE. WHY NOT RUN AN ADVERTISEMENT ABOUT YOURSELF IN TWO OR THREE ISSUES?

WRITE
THE FOUNDRY
CLASSIFIED ADVERTISING DEPT.
PENTON BLDG., CLEVELAND 13, OHIO

LIQUIDATING FOUNDRY

BUILDINGS AND EQUIPMENT

85,000 sq. ft. of Floor Area

Siding to Pittsburgh and Lake Erie Railroad

Good Utilities

Brick and Steel Buildings

Modern Production Equipment

Located in City of 25,000

This modern Iron and Brass Foundry in Monessen, Pa. is to be liquidated. Will sell buildings, land and equipment, wholly or in part. Equipment includes 1 No. 9½ Whiting cupola; 30 molding machines; 1 gas fired melting furnace; 7 cranes, 2—10 ton; 1 motive type sand slinger; 1 Rotoblast; 1 Tumblast; 2 Motowlift trucks; 4 gas fired core ovens (one never used); 4 Simpson sand mixers—also pattern shop with complete equipment; flasks, jackets, hoists and miscellaneous items.

Contact

MONESSEN FOUNDRY DIVISION — ROCKWELL MANUFACTURING COMPANY
MONESSEN, PA.

CLASSIFIED ADVERTISING RATES

POSITION WANTED—Minimum advertisement set solid, 30 words, $2.00. Additional words 7c each.

ALL OTHERS—"Help Wanted"—"For Sale"—"Wanted"—"Personals"—"Services", etc., minimum advertisement set solid, 30 words or less, $4.00. Additional words 12c each.

NOTE—If replies are to be sent to a box number in care of THE FOUNDRY, add 6 words to your advertisement for box number and address.

Any advertisement set in all capital letters, add 50% to the above rates.

INCH RATES PER INSERTION

Single Column 2¼" Wide	One Time	Three Times	Six Times	Twelve Times
1 inch	$ 12.00	$11.00	$10.00	$ 9.00
2 inches	21.75	20.00	18.25	16.75
3 inches	32.00	29.25	26.75	24.00
4 inches	40.00	36.75	33.25	30.00
5 inches, ½ col.	48.00	44.00	40.00	36.00
6 inches	58.75	53.25	48.00	42.75
7 inches	66.00	60.00	54.00	48.00
8 inches	73.25	66.75	60.00	53.25
10 inches, 1 col. .	88.00	80.00	72.00	64.00
Half Page	130.00	120.00	110.00	100.00
Full Page	220.00	200.00	180.00	160.00

Remittance should accompany advertisement when submitted—Cash Discount 2%, 10 days.

THE FOUNDRY—

Penton Building, Cleveland 13, Ohio

HERE'S A SPECIAL DEPARTMENT THAT YOU SHOULD KNOW ABOUT

FROM time to time an unusual group of specialists and engineers in our plant render a unique service to the Automobile, and Allied Industries by designing and process engineering special equipment planned and fitted to their individual custom requirements.

✓ Check this list of the many special custom orders we are in a position to handle in a prompt, economical manner.

CORE WIRE BENDING FIXTURE *(Air operated)*	
CORE WIRE BENDING DIES	
CORE DRAWING FIXTURES	
CORE GRINDING FIXTURES *(multiple grinding operation)*	
CORE TRIMMING FIXTURES (Contour)	
CORE PASTING FIXTURES	
CORE LOADING FIXTURES	
CORE SETTING FIXTURES	
CORE SETTING GAGES	
CORE CHECKING GAGES	
CASTING CHECKING GAGES	
CASTING "WATER TEST FIXTURES"	

Our Designers and Engineers cordially invite you to write, wire or phone us for complete information covering your own particular problems, or to request a personal interview at your plant.

ETERNA METAL

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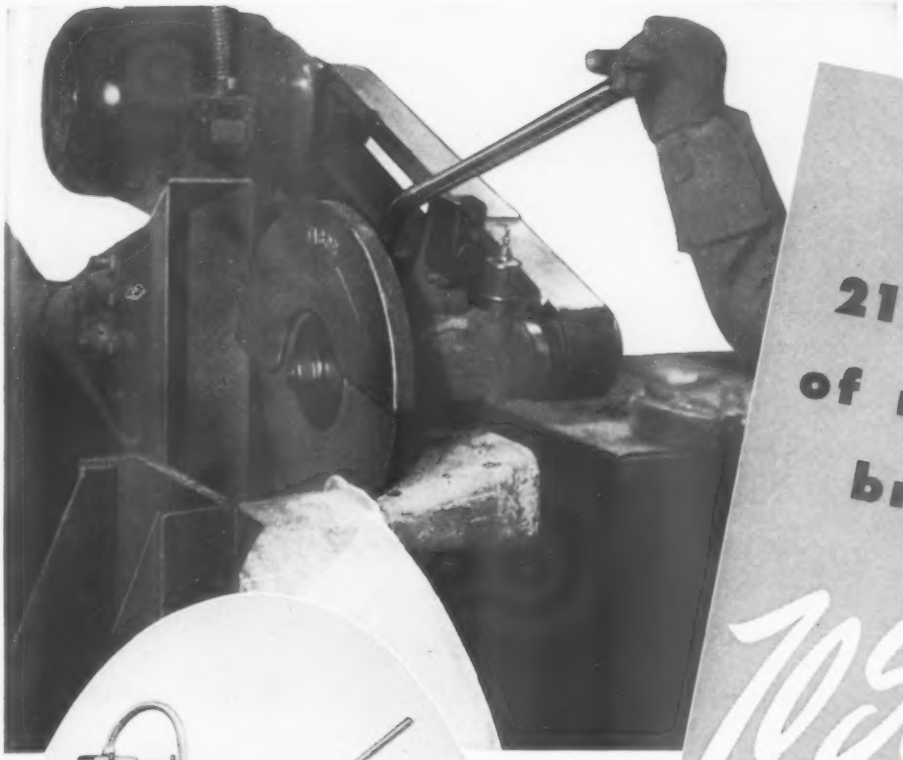

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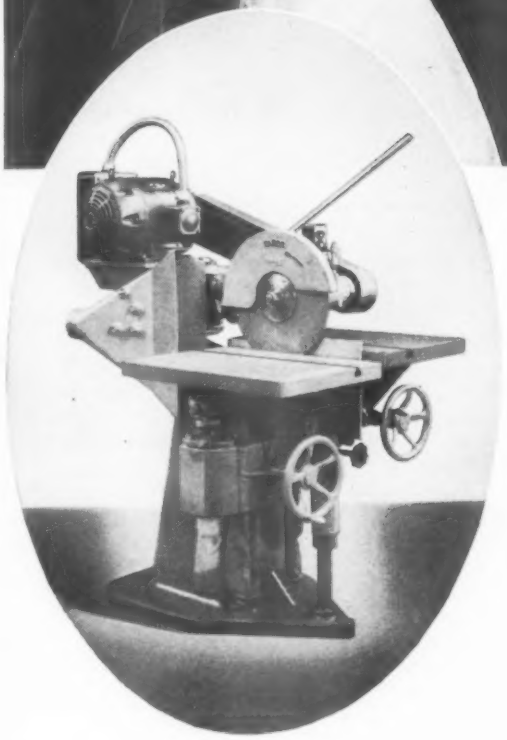

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SPECIFICATIONS

Motor	Table Size (Split Type)	Wheel Diam.	Max. Height of Work Under Wheel
10 H.P.	36" x 25"	16" Max. Thickness—5/32"	20" (with head over table) 46" (with head swung to side)
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All motors fully enclosed, fan-cooled, ball bearing			

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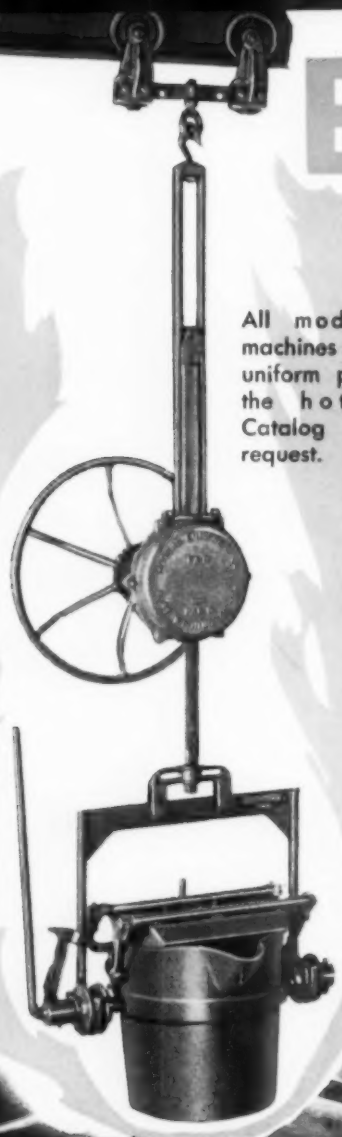

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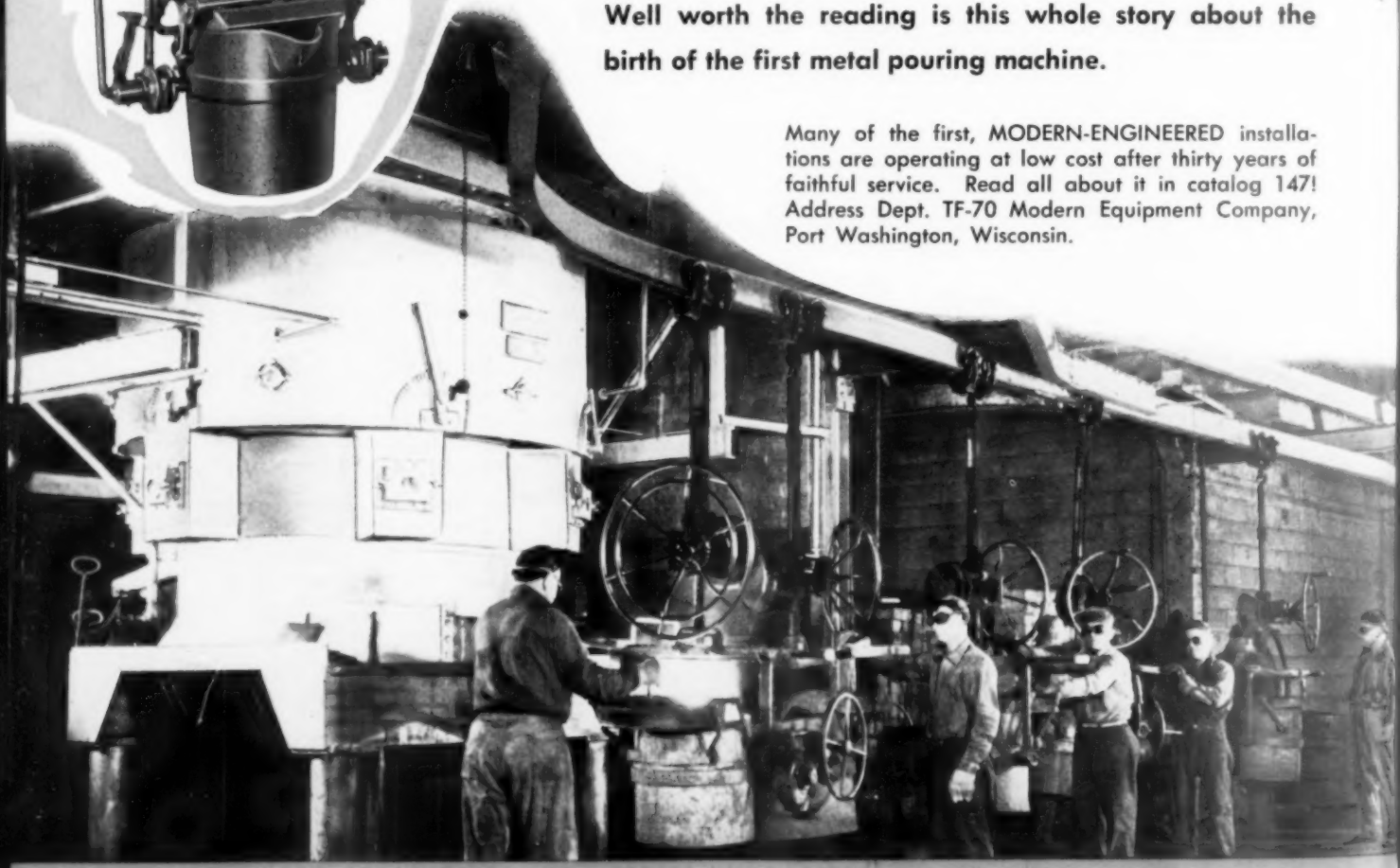

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DOES NOT "BOIL OR BUBBLE OUT" between pasted joints when subjected to oven temperatures.

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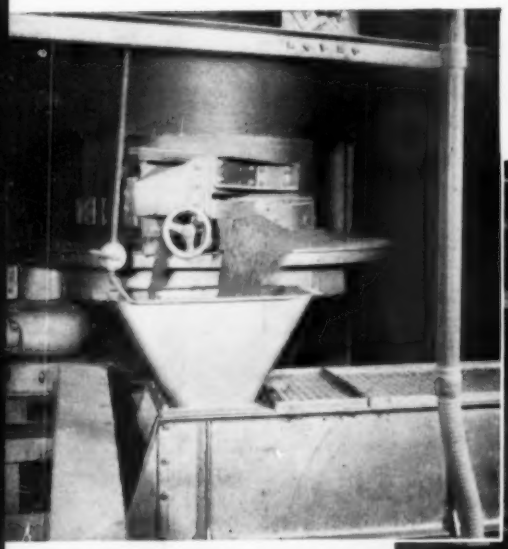
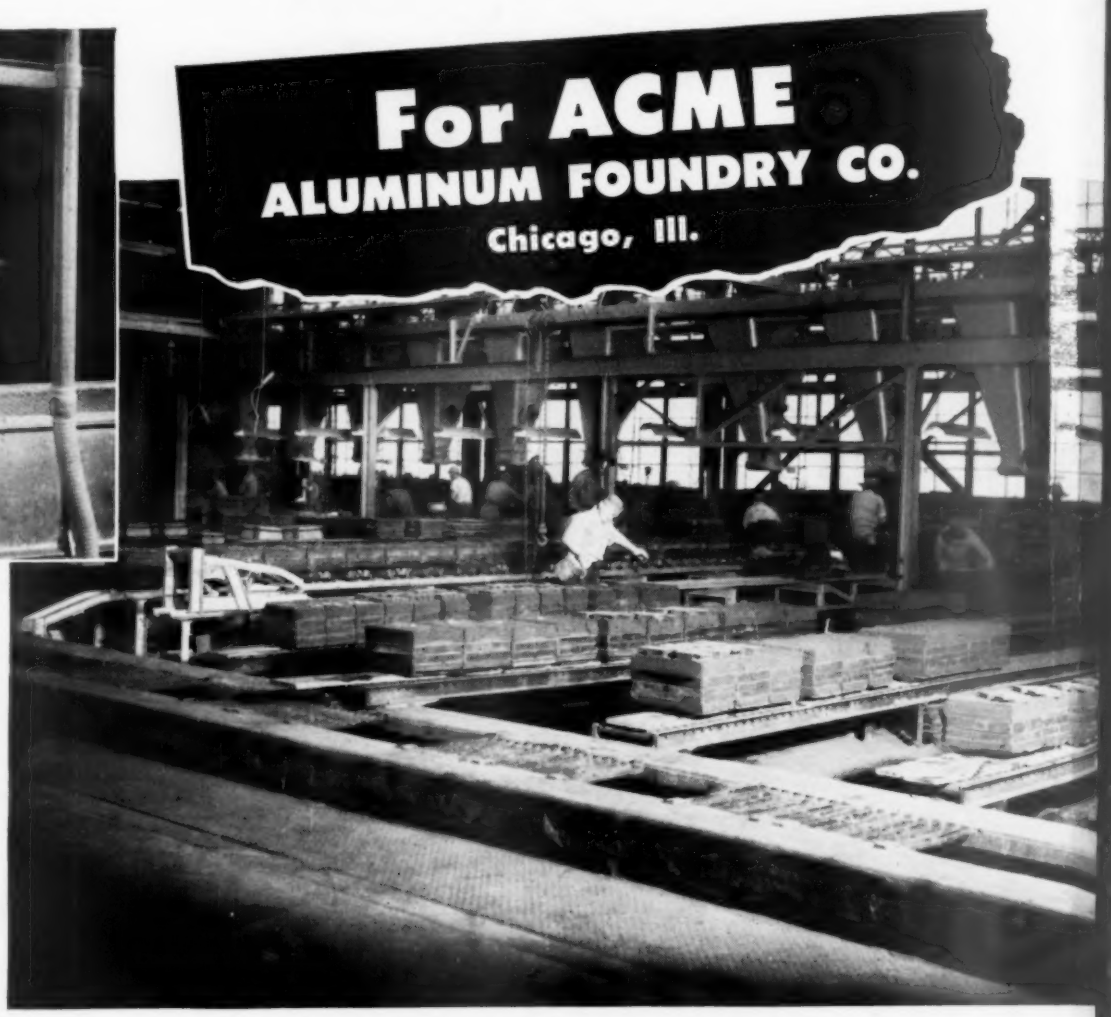


A close-up view of the conical bottom of the 1600-cubic-foot capacity storage bin and the 7-foot-diameter revolving-table feeder for uniform feed of the sand to mixer.



General view of molding floor showing complete sand distribution system with 9 of the 14 hoppers supplying the molding stations; the gravity-roll and pallet-type conveyors store the molds and deliver them to the 100-foot oscillating conveyor, in the trench in the foreground, where both the sand and the castings are carried to the shakeout screen.

The 36-inch-wide, no-leak apron conveyor for handling the castings from the shakeout screen to the sorting area. In the background are the conical bottom and table feeder for the sand-storage bin.

Complete LINK-BELT Mechanized Handling for SAND, MOLDS and CASTINGS

Here is another example of a mechanized foundry system engineered, manufactured and installed by Link-Belt. It is a typical aluminum foundry application for the preparation and complete handling of approximately 25 tons of sand an hour, in addition to handling molds and castings. Manual handling is kept to a minimum, working conditions are improved and unit costs are lower.

A 1600-cubic-foot storage bin with revolving-table feeder provides a uniform feed of sand to a single-paddle-type continuous mixer. This mixer prepares and delivers the sand to the prepared-sand elevator. The sand discharges from the elevator to a Link-Belt Revivifier and distributing belt conveyor arranged with 14 plows and hoppers supplying sand to the molders' stations.

These hoppers provide overhead sand at each molding station, minimizing molder fatigue and speeding up the actual molding. Gravity-roll and pallet-type conveyors furnish adequate mold storage and convey the molds to the shakeout zone.

An oscillating conveyor delivers the sand and castings to a Link-Belt "PD" shakeout screen which separates the sand and castings. The castings are handled on a no-leak apron conveyor provided with a horizontal station at the top for sorting.

The sand from the shakeout screen is transferred on a magnetic belt conveyor to a Link-Belt bucket elevator and then to an aerator where it is further cooled. A belt conveyor takes it to a Link-Belt unbalanced-pulley-type vibrating screen where core butts and other refuse are removed before delivering the sand to the large storage bin ready for re-use.

Link-Belt foundry engineering experience can be a big help in the improvement of your sand preparation and handling methods.

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